THE AMERICAN RADIO RELAY LEAGUE, INC.
INTERNATIONAL SECRETARIAT OF THE INTERNATIONAL AMATEUR RADIO UNION
ADMINISTRATIVE HEADQUARTERS NEWINGTON, CONNECTICUT, U.S.A. 06111

July 17, 1986

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Gary McDuffie, AGØN
Rte 1, Box 464
Bayard NE 69334

Dear Gary:

Thanks for letting us have your views on HF packet channelization and what packet is good for.

The Digital Committee has recently forwarded tentative frequency recommendations to the Board of Directors and will continue to study some of the remaining frequency questions for the rest of this year. Virtually all packet operation takes place on specific channels, particularly those used for message forwarding. You're right that there has been some "off-channel" operation, some of which has caused temporary interference to beacons on 14100 kHz. We've mentioned this in Gateway and could probably do some more tutorial pieces on packet-frequency usage.

While it's not fair to say that the League has ignored saying what packet is good for (if you look at Gateway, the Handbook, QST articles and the five ARRL Computer Networking Conference proceedings), but there has been more technical material than anything else. One good application is emergency communications, and we have a QST article on that scheduled for appearance soon. For packet articles, as for other subjects, we are largely dependent on authors' contributed articles. We'd like to publish more packet applications.

I'll pass your letter to the Digital Committee members.

73,

Paul L. Rinaldo, W4RI
Chairman, AD Hoc Committee on
Amateur Radio Digital Communication

PR

RECEIVED
A.R.R.L. #2

A G Ø N

Route 1 Box 464
Bayard, NE 69334
27-June-86

1986 JUL -9 PM 1:06

Ad Hoc Committee on Digital Communications
American Radio Relay League
225 Main Street
Newington, CT 06111

Dear Sirs:

I would like to urge the committee to support channelized operation of packet radio on all of the amateur bands, including and especially in the HF range.

As you are no doubt aware, stations who operate just off of the packet channel on HF cause considerable QRM to those who are on the established channel. The receive passband of some of the TNC's on the air today causes the unknowing operator to just tune to some place where he can copy some of the stations that are transmitting and assume that everyone can hear him too (in particular, the PK-64 with HFM-64 will copy signals that are +/- 50 cycles). Well, we DO HEAR him but we DON'T PRINT him most of the time. He is just far enough off frequency that a good (narrower) TNC won't recognize him and will transmit data, even though the desired signal may be on at the time and cannot be separated from the offender. This causes many needless collisions and many lost contacts. I feel that this problem is due partially to the lack of a standard tone pair to use for HF packet and compounded by the fact that the manufacturers choose to not tell the purchaser how to get on the proper frequency with their particular tone pair. To a certain extent, it seems that every manufacturer has his own idea of what tones to use. Why can't the industry settle on a pair for HF, like they have for VHF?

The second problem has to do with the PBBS stations. I have few complaints with the BBS's since I think that they should be a prime focus of packet activity. I do, however, think that they should be set up on channels more or less by themselves, away from the "ragchew" channels. If you listen to HF packet very much, you will soon realize that all it takes is for one BBS to be called up on a busy ragchew channel to clog things up. Then, to top it all off, some guy who doesn't stop to realize what it will cause to happen, activates a second BBS and the frequency is useless. When I call a BBS, I listen for quite a while to see if there is another one activated at the time. If there is, I wait. I don't want to be the cause of someone losing a contact that he has tried hard to get. I'm sorry to say that most other stations don't return the favor though. The point is that I think that the BBS should be on a shared frequency with other PBBS stations, just like the national autostart rtty group on 14.085. There could be two or possibly three channels set up as PBBS channels just for that purpose. Any ragchewing would take place on one or two similarly set aside channels for that purpose. The BBS channels could handle probably two at a time and the ragchewers would have a ball without having so many retries and long waits while the PBBS dumps long files on the channel.

I think that the League and manufacturers are doing packet radio a big injustice by promoting it without stressing what it is good for. Most people get

on packet thinking that it is going to be a cure all mode for ragchewing. All they know is that it is the latest rage and they must give it a try. A few hundred dollars and 6 months later, they are sitting there wondering why in the world they spent the money. Packet is one of the worst modes there is for ordinary QSO's. It IS just what the doctor ordered for handling messages and transferring data files from one station to the next because it is virtually error free. That is also the reason that it is basically unsuitable for QSO type work. Error free communications is not needed and merely slows down communications when talking on a one on one basis. AMTOR is much more suited for talking with your buddy and for weak signal work. Packet it useless when the signal is in the noise.

Please help to get things better organized on the bands by promoting better channel utilization and quit pushing packet radio blindly into the shacks of the thousands of plug-in-appliance ops who don't know what they are getting into. Digital communications is here to stay. Let's start planning for it's use in a more realistic way.

Thank you for listening.

Sincerely,

Gary McDuffie

Gary McDuffie

Paul

I thought QST readers might be interested in what is possible on 20 Meter Packet.

As one new to packet I was surprised at the activity.

73
Ken Stern
K5VZN/VP2MKS

Please Excuse My typing !!

July 5, 1986

TO: Ed Raso, WA2FTC
Editor, The ARRL Packet Radio Newsletter
225 Main Street
Newington, CT 06111

PACKET RADIO ARRIVES ON MONTSERRAT ISLAND, WEST INDIES

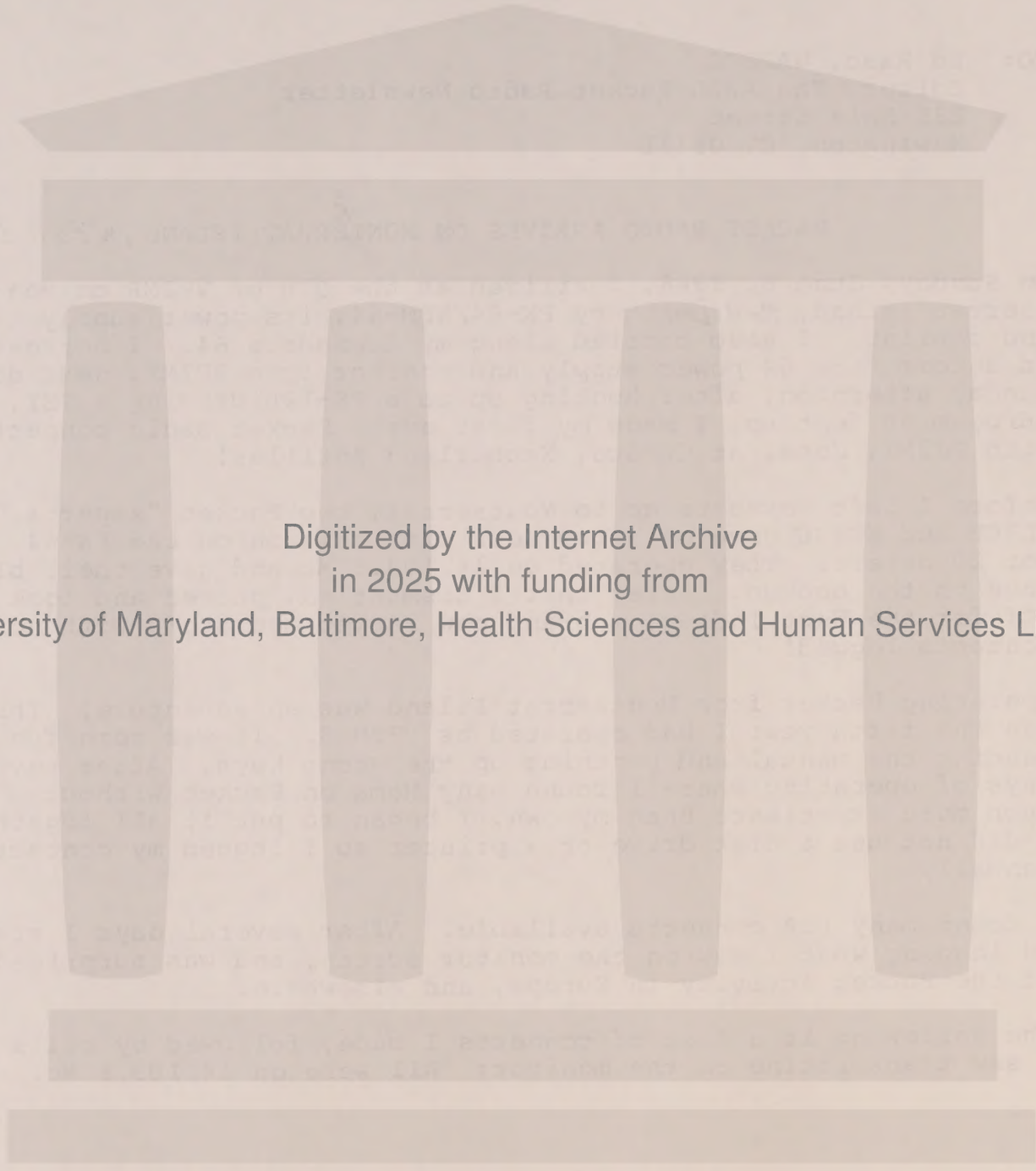
On Sunday, June 8, 1986, I arrived at the QTH of VP2MR on Montserrat Island, W.I. with my PK-64/HFM-64, its power supply and cabling. I also carried along my Commodore 64. I borrowed a Commodore 64 power supply and monitor from VP2MF, next door. Sunday afternoon, after hooking up to a TS-120 driving a TET, 3E beam 60 feet up, I made my first ever, Packet Radio connect with PJ2MI, Jose, at Curaco, Netherland Antilles!

Before I left Texas to go to Montserrat, two Packet "experts," KL7CB and KE5JU gave me a two hour cram session on the PK-64, for 20 meters. They operated on 14.103.5 Mc and gave their blessings to the hookup. After that I dismantled, packed and took off for the West Indies, a brand new Packet operator, with no contacts logged!

Operating Packet from Montserrat Island was an adventure! This was the fifth year I had operated as VP2MKS. It was some fun, reading the manual and punching up the wrong keys. After several days of operating where I found many Hams on Packet without much more experience than my own, I began to put it all together. I did not use a disk drive or a printer so I logged my contacts manually.

I found many USA connects available. After several days I started logging what I saw on the monitor screen, and was surprised at the Packet activity in Europe, and elsewhere.

The following is a list of connects I made, followed by calls I saw transmitting on the monitor: All were on 14.103.5 Mc.



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https://archive.org/details/arrl-comm-1986-07

G4VLS-Paul
G5DS-John
KG4TM-Tim
G3LDI-Roger
DL3AAP
LA60CA-KNUT
G3IFM
G4BIO-Andy
PA3EAE-Vera
IØWX-Pete
ON8HB-Alain
IØJX-Tony
HK5FIR-Diego
PJ2MI-Jose
IØCNR-Raffaele
JA1DST-Ninoru

The following I monitored and could tell they were transmitting by the PK-64/HFM-64 *system.

DJ6TZ
G3NRW
TI3DJI
ZF1GC
HK3FW
LU8DSS
TI8ALG
ZS2BK
I5UCH
9M2CR-1
TI3DJI
XE4EN
DJØSO
F5PX
HK4CCX
HK3CBA
HP1XJZ
I2JR
YB5QZ
GM3DUR
HK3AVA
SM5BKI
XE1OE
OH1VR
ON7LE
I5CW
DF2EG
JA3MQY
DL1AR
DL1MI

I had a "Connect Request" from 9H1E on Malta, but I was trying to handle Multiple Connects from Holland, Germany, England, Norway, and Wales. I did not have the experience to get back to him.

This report should show that 20 Meter Packet is taking off. What other type of communication allows one to communicate on the visual screen with IØCNR near "Roma," and listen to the World News from the BBC in London at the same time?

Ken Shaw

Ken Shaw, Life Member ARRL
K5VZN/VP2MKS
2014 Boston Dr.
Irving, Texas 75061

cc: Perry Brittain
W5STI/VP2MR

Konrad Hollatz
VP2MF

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~~QST~~
OFFICIAL JOURNAL

Emile Alline, NE5S
773 Rosa Ave.
Metairie, LA 70005

Dear Emile:

Thank you for your endorsement of Pat Fagan, WA5DVV for the League STA on packet automatic operation. I have passed your comments on to the Digital Committee, which is working on the STA.

Incidentally, Pat is one of 43 HF gateway operators who is receiving a detailed questionnaire relating to HF packet message forwarding and to the STA.

73,

Paul L. Rinaldo, W4RI
Chairman, AD Hoc Committee on
Amateur Radio Digital Communication

12 July 86

Gentlemen:

Read in Gateway that an STA is being applied for to allow a test of 15 automatic packet gateways on HF. I am sure that you will have 2-3 times that many applicants. May I please offer the following for your consideration:

I strongly recommend Mr. Pat Fagan, WA5DVV, for your STA testing. Pat has done more to promote packet in LA, MS, & AL than anyone I know of in all of these states. He has operated his packet BBS on a consistent, gentlemenly manner day and nite. He was the prime mover in forming the statewide MS packet group (MARDA). Through his leadership and subtle suggestions, he literally "embarassed" LA into forming LAPRS ( The Louisiana Amateur Packet Radio Society ). I do not have much info on AL, but I am certain that he was involved there also.

Above all, Pat is as committed to packet as a pig is committed to breakfast! He had, at last count, five computers, half a dozen TNC's, etc. He is now running a gateway and two BBS systems in a through, consistent manner, while patiently answering all of our dumb questions on packet. I am sure that when the next hurricane hits our area, WA5DVV will be showing how packet can do the job!

Thanks & '73

Emile

Emile Alline NE5S
773 Rosa Ave.
Metairie, LA 70005
504-834-6444

President, LAPRS

## *Kantronics Introduces*

# 2400 BAUD PACKET

## *Not Just For All Computers But For All TNC's Too!*

## WHY 2400 BAUD?

Packet channels are congested, and faster is better. So Kantronics has designed a 2400 baud PSK (phase shift keying) modem and included it in an all new KPC-2400. In addition, we are making this modem available in PC-board form to add to your TNC-1 or TNC-2, cables included! If you have a KPC-1 or KPC-2, we'll take it in trade for a new KPC-2400.

Since October 28, 1982, the rules have allowed for baud rates up to 19.6K. Of course, we've all been operating at 1200 baud with Bell 202 (1200 baud) standard tones. However, the bandwidth of our radios is fully capable of running up to 2400 baud, giving us congestion relief. Our phase shift modem (PSK) takes advantage of the bandwidth available and the reasonable linearity of the audio channels, and it is designed with the V.26TER CCITT specification in mind. To add to your TNC or trade for a new KPC-2400, see facing page.

# KPC-2400

## *All the Features of KPC-2 Plus 2400 Baud*

### KPC-2400 Features

- AX.25 version 2 software
- Supports multiple connects
- All EPROM software is Kantronics written and U.S. copyrighted
- Advanced software HDLC, eliminating expensive chips
- In-house programmers/engineers
- In-house service representatives
- Periodic updates —we keep you on the air

When we set out to design the KPC-2400 ™, we wanted it to be compatible with existing units, and it is. The KPC-2400 features both the KPC-2 modem for 300 baud HF and 1200 baud VHF work, and a new phase shift keying (PSK) modem for 2400 baud operation. All modes are software selectable with HBAUD command!

In addition, we've retained the RS-232/TTL jumper for easy direct interface to PC compatibles or the VIC/C-64 series. Hence, with the KPC-2400 you get HF, VHF, and 2400 baud packet with all computers that have a serial port, all in one!

The KPC-2400 of course, retains the version 2 software with multiple connects, and we've included an on-board memory diagnostic routine too.

*Suggested Retail $329.00*

## 6 Timing arrangements

Clocks should be included in the modem to provide the data terminal equipment with transmitter signal element timing, circuit 114 and receiver signal element timing, circuit 115. Alternatively, the transmitter signal element timing may be originated in the data terminal equipment instead of in the data circuit-terminating equipment and be transferred to the modem via circuit 113.

## 7 Electrical characteristics of interchange circuits

Use of electrical characteristics conforming to Recommendation V.28 is recommended together with the connector and pin assignment plan specified by ISO 2110.

*Note* – Manufacturers may wish to note that the long-term objective is to replace electrical characteristics specified in Recommendation V.28, and that Study Group XVII has agreed that the work shall proceed to develop a more efficient, all balanced, interface for the V-Series application which minimizes the number of interchange circuits.

8 The following information is provided to assist equipment manufacturers.

The data modem should have no adjustment for send level or receive sensitivity under the control of the operator.

9 When echo control device disabling is required, it is recommended that the procedures specified in Recommendation V.25 be followed.

## 10 Fixed compromise equalizer

A fixed compromise equalizer shall be incorporated into the receiver. The characteristics of this equalizer may be selected by Administrations but this should be the matter for further study.

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### Reference

[1] CCITT Recommendation *Standardization of FMVFT systems for a modulation rate of 50 bauds*, Vol. VII, Rec. R.35.

**Recommendation V.26 *ter***

# 2400 BITS PER SECOND DUPLEX MODEM USING THE ECHO CANCELLATION TECHNIQUE STANDARDIZED FOR USE ON THE GENERAL SWITCHED TELEPHONE NETWORK AND ON POINT-TO-POINT 2-WIRE LEASED TELEPHONE-TYPE CIRCUITS

*(Malaga-Torremolinos, 1984)*

The CCITT,

*considering*

(a) that there is a demand for data transmission at 2400 bit/s in the duplex mode on the general switched telephone network (GSTN) and on point-to-point 2-wire leased telephone-type circuits;

(b) that there will be a demand to have compatibility with higher data signalling rate duplex modems in the fall-back mode;

(c) that in this case the echo cancellation technique (ECT) is foreseen,

*unanimously declares*

the view that the characteristics of the modems for this service shall provisionally be as follows:

## 1 Introduction

This modem is intended for use on connections on the GSTN and on point-to-point 2-wire leased telephone-type circuits (see Note 1). Its principal characterisics are as follows:

a) duplex mode of operation on the GSTN and point-to-point leased circuits,

b) half-duplex mode of operation (optional) on the GSTN and point-to-point leased circuits (Note 2),

c) channel separation by echo cancellation,

d) differential phase-shift modulation for each channel with synchronous line transmission at 1200 baud (nominal),

e) inclusion of a scrambler,

f) inclusion of a compromise or adaptive equalizer,

g) inclusion of test facilities,

h) operation with data terminal equipment (DTE) in the following modes:

2400 bit/s synchronous,

1200 bit/s synchronous (fall-back rate),

2400 bit/s start stop (optional),

1200 bit/s start stop (optional) (fall-back rate),

i) inclusion of an operating sequence intended to allow interworking with 2-wire duplex 4800 bit/s modem (which modem is for further study).

*Note 1* – In certain countries the use of such a modem over the GSTN may not be allowed.

*Note 2* – When the optional half-duplex mode of operation is used, provisions in § 7 shall supersede provisions given elsewhere in this Recommendation.

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## 2 Line signals

### 2.1 *Carrier frequency*

The carrier frequency shall be 1800 ± 1 Hz. No separate pilot tones are provided.

### 2.2 *Data line signal level*

The power levels used will conform to Recommendation V.2.

### 2.3 *Equalizer*

If a fixed compromise equalizer is used, it shall be incorporated in the receiver. The characteristics of this equalizer may be selected by Administrations.

The possibility of producing compromise equalizer characteristics for international connections is for further study.

If an adaptive equalizer is used, it shall be able to converge on data signals at 2400 bit/s without a training sequence.

### 2.4 *Spectrum and group-delay characteristics*

A 100% raised cosine amplitude spectrum shaping is equally divided between the receiver and transmitter. The energy density at 1200 Hz and 2400 Hz shall be attenuated 3.0 dB ± 2.0 dB with respect to the maximum energy density between 1200 Hz and 2400 Hz.

The group-delay of the transmit filters shall be within ± 100 microseconds over the frequency range 1200-2400 Hz.

## 2.5 *Modulation*

### 2.5.1 *Data signalling rates*

The data signalling rate transmitted to line shall be 2400 bit/s or 1200 bit/s ± 0.01% with a modulation rate of 1200 baud ± 0.01%.

### 2.5.2 *Encoding of data bits*

#### 2.5.2.1 *2400 bits per second*

At 2400 bit/s the data stream is divided into groups of two bits (dibits). Each dibit is encoded as a phase change relative to the phase of the immediately preceding signal element (see Table 1/V.26 *ter*). At the receiver, the dibits are decoded and reassembled in the correct order. The left-hand digit of the dibit is the one occurring first in the data stream as it enters the modulator portion of the modem after the scrambler.

TABLE 1/V.26 *ter*

**Line encoding at 2400 bit/s**

| Dibit values | Phase change (see Note) |
|---|---|
| 00 | 0° |
| 01 | 90° |
| 11 | 180° |
| 10 | 270° |

*Note* – The phase change is the actual on-line phase shift in the transition region from the centre of one signalling element to the centre of the following signalling element.

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#### 2.5.2.2 *1200 bits per second*

At 1200 bit/s each bit shall be encoded as a phase change relative to the phase of the preceding signal element (see Table 2/V.26 *ter*).

TABLE 2/V.26 *ter*

**Line encoding at 1200 bit/s**

| Bit values | Phase change (see Note) |
|---|---|
| 0 | 0° |
| 1 | 180° |

*Note* – The phase change is the actual on-line phase shift in the transition region from the centre of one signalling element to the centre of the following signalling element.

2.6 *Received signal frequency tolerance*

The receiver shall be able to operate with frequency offsets in the signal received from the other modem of up to ± 7 Hz.

2.7 *Synchronizing signals*

Synchronizing signals are used in the operating sequence and in the half-duplex mode (see §§ 6.3 and 7). The synchronizing signals, for both data signalling rates, are divided into two segments as follows:

2.7.1 The composition of segment 1 is continuous 180° phase reversals for 32 symbol intervals.

2.7.2 Segment 2 is a pattern derived by scrambling binary ones with the scramblers defined in § 5. The length of the pattern is 64 bits (32 symbol intervals) for 2400 bit/s and 64 bit/s (64 symbol intervals) for 1200 bit/s. The patterns are defined in Table 3/V.26 *ter*. See also Appendix I.

TABLE 3/V.26 *ter*

| Data signalling rate | Scrambler (see § 5) | Segment 2 phase changes (in degrees) |
|---|---|---|
| 2400 bit/s | GPC | 0, 180, 180, 180, 180, 0, 0, 0, 0, 180, 180, 270, 90, 180, 0, 0, 90, 180, 0 ... |
| 2400 bit/s | GPA | 0, 180, 180, 180, 180, 0, 0, 0, 0, 180, 180, 270, 90, 180, 0, 180, 180, 270, 0 ... |
| 1200 bit/s | GPC | 0, 0, 180, 180, 180, 180, 180, 180, 180, 180, 0, 0, 0, 0, 0, 0, 0, 0, 180, 180, 180, 180, 180, 0, 0, 180, 180, 180, 0, 0, 0, 0, 0, 180, 180, 180 ... |
| 1200 bit/s | GPA | 0, 0, 180, 180, 180, 180, 180, 180, 180, 180, 0, 0, 0, 0, 0, 0, 0, 0, 180, 180, 180, 180, 180, 0, 0, 180, 180, 180, 0, 0, 180, 180, 180, 0, 180, 0 ... |

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## 3 Interchange circuits

3.1 *Essential and optional interchange circuits*

These are listed in Table 4/V.26 *ter*.

3.2 *Circuit 106 response times* (see Table 5/V.26 *ter*)

Circuit 106 response times are from the application of an ON or OFF condition on circuit 105. See also § 6.3 for conditions of circuit 106 during the operating sequence.

3.3 *Threshold and response times of circuit 109*

3.3.1 *Threshold*

The level of received line signal at the receive line terminals of the modem for all types of connections, i.e. the general switched telephone network or non-switched 2-wire leased telephone type circuits, is:

- greater than −43 dBm: circuit 109 ON
- less than −48 dBm: circuit 109 OFF

Where transmission conditions are known and allowed, it may be desirable at the time of modem installation to change these response levels of the received line signal detector to less sensitive values (e.g. −33 dBm and −38 dBm respectively).

TABLE 4/V.26 *ter*

| Interchange circuit (see Note 1) | | Notes |
|---|---|---|
| No. | Designation | |
| 102 | Signal ground or common return | |
| 103 | Transmitted data | |
| 104 | Received data | |
| 105 | Request to send | |
| 106 | Ready for sending | |
| 107 | Data set ready | |
| 108/1 or | Connect data set to line | 2 |
| 108/2 | Data terminal ready | 2 |
| 109 | Data channel received line signal detector | |
| 111 | Data signalling rate selector (DTE source) | |
| 112 | Data signalling rate selector (DCE source) | 3 |
| 113 | Transmitter signal element timing (DTE source) | 4 |
| 114 | Transmitter signal element timing (DCE source) | 5 |
| 115 | Receiver signal element timing (DCE source) | 5 |
| 125 | Calling indicator | 6 |
| 140 | Loopback/maintenance test | |
| 141 | Local loopback | |
| 142 | Test indicator | |

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*Note 1* – All essential interchange circuits and any others which are provided shall comply with the functional and operational requirements of Recommendation V.24. All interchange circuits provided shall be properly terminated in the data terminal equipment and in the data circuit-terminating equipment in accordance with the appropriate Recommendation for electrical characteristics (see § 3.5).

*Note 2* – This circuit shall be capable of operation as circuit 108/1 or circuit 108/2 depending on its use.

*Note 3* – This circuit is optional.

*Note 4* – When the modem is not operating in a synchronous mode at the interface, any signals on circuit 113 shall be disregarded and the DTE may not have a generator connected.

*Note 5* – When the modem is not operating in a synchronous mode, this circuit shall be clamped to the OFF condition and the DTE may not terminate the circuit.

*Note 6* – This circuit is for use with the general switched telephone network only.

TABLE 5/V.26 *ter*

| | Constant carrier |
|---|---|
| *Circuit 106* | |
| OFF to ON | < 2 ms |
| ON to OFF | < 2 ms |

In addition, for use over special quality leased circuits (see Recommendation M.1020) the response levels of the received line signal detector shall be:

- greater than −26 dBm: circuit 109 ON
- less than −31 dBm: circuit 109 OFF

The condition of circuit 109 between the ON and OFF levels is not specified, except that the signal detector shall exhibit a hysteresis action such that the level at which the OFF to ON transition occurs shall be at least 2 dB greater than that for the ON to OFF transition.

3.3.2 *Response time*

Circuit 109 must turn ON after synchronizing is completed and prior to user data appearing on circuit 104.

The ON to OFF response time of circuit 109 is 5 ms to 15 ms. See also § 6.3 for the condition of circuit 109 during the operating sequence.

Following a drop-out after the initial handshake, circuit 109 shall be turned ON 40 to 50 ms after the level of the receiver signal appearing at the line terminal of the modem exceeds the relevant threshold defined in § 3.3.1.

3.4 *Timing arrangement*

Clocks shall be included in the modem to provide the DTE with transmitter element timing (circuit 114) and receiver signal element timing (circuit 115). The transmitter element timing may be originated in the DTE and be transferred to the modem via the appropriate interchange circuit, circuit 113.

3.5 *Electrical characteristics of interchange circuits*

Use of electrical characteristics conforming to Recommendation V.28 is recommended together with the connector and pin assignment plan specified by ISO 2110.

*Note* – Manufacturers may wish to note that the long-term objective is to replace electrical characteristics specified in Recommendation V.28, and that Study Group XVII has agreed that the work shall proceed to develop a more efficient, all-balanced, interface for the V-Series application which minimizes the number of interchange circuits.

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3.6 *Fault condition of interchange circuits*

(See § 7 of Recommendation V.28 for association of the receiver failure detection types.)

3.6.1 The DTE should interpret a fault condition on circuit 107 as an OFF condition using failure detection type 1.

3.6.2 The DCE should interpret a fault condition on circuits 105 and 108 as an OFF condition using failure detection type 1.

3.6.3 All other circuits not referred to above may use failure detection types 0 or 1.

## 4 Modes of operation

The modem can be configured for the following modes of operation:

Mode i) 2400 bit/s ± 0.01% synchronous

Mode ii) 2400 bit/s start-stop 8, 9, 10 or 11 bits per character (optional)

Mode iii) 1200 bit/s ± 0.01% synchronous

Mode iv) 1200 bit/s start-stop 8, 9, 10 or 11 bits per character (optional).

4.1 *Transmitter*

In the synchronous modes of operation, the modem shall accept synchronous data from the DTE on circuit 103 under control of circuit 113 or circuit 114. The data shall then be scrambled in accordance with § 5 and then passed to the modulator for encoding in accordance with § 2.5.

When circuit 114 is used, the modem shall derive its line signal clock from the internal clock source or, alternatively, from the receive signal element timing.

In the start-stop modes, the modem shall accept a data stream of start-stop characters from the DTE at a nominal rate of 2400 or 1200 bit/s. The start-stop data shall be converted to a form suitable for transmission synchronously at 2400 or 1200 bit/s ± 0.01%, then scrambled in accordance with § 5 and then passed to the modulator for encoding in accordance with § 2.5. The modem shall derive its line signal clock from the internal clock source or, alternatively, from the receive signal element timing.

It shall be possible to condition the converter to accept the following character formats, viz:

a) a one-unit start element, followed by 7 data units, and a stop element of one unit in length (9-bit characters);

b) a one-unit start element, followed by 8 data units, and a stop element of one unit in length (10-bit characters);

c) a one-unit start element, followed by 9 data units, and a stop element of one unit in length (11-bit characters).

The converter may also accept characters consisting of:

d) a one-unit start element, followed by 6 data units, and a stop element of one unit in length (8-bit characters).

Note that character formats c) and d) do not conform to International Alphabet No. 5.

The character format selected shall be the same for both transmitter and receiver. The characters shall be in accordance with Recommendation V.4 regardless of whether they conform to International Alphabet No. 5. It shall be possible to transmit characters contiguously or with any additional continuous stop element of arbitrary length between characters.

*Note* – In each of the four formats, data units can be replaced by additional stop units. For example, format c) will allow 11-bit characters consisting of a one-unit start element, followed by 8 data units and a stop element of 2 units to be handled.

4.1.1 *Signalling rate range*

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The intracharacter signalling rate (signalling rate of the start bit and information bits within each character) provided by the DTE on circuit 103 must be 2400 or 1200 bit/s +1%, −2.5%. In Mode ii), the character rate (the reciprocal of the time interval between successive start bits) provided by the DTE over circuit 103 must not exceed:

303 characters per second for 8-bit characters

269.3 characters per second for 9-bit characters

242.4 characters per second for 10-bit characters

220.3 characters per second for 11-bit characters.

The start-stop to synchronous converter in the modem transmitter shall as often as is necessary delete the stop bits of the incoming characters in order to attain the nominal transmission rate. No more than one stop bit shall be deleted for any 8 consecutive characters.

When the character rate provided by the DTE on circuit 103 is less than:

300 characters per second for 8-bit characters

266.6 characters per second for 9-bit characters

240 characters per second for 10-bit characters

218.2 characters per second for 11-bit characters,

the start-stop to synchronous converter in the modem is transmitting more bits per second than are provided by the DTE. The converter shall therefore insert extra stop bits in between the transmitted characters.

In Mode iv) the character rates are half those for Mode ii).

4.1.2 *Extended signalling rate range (optional)*

Certain DTEs and multiplexers are not within the +1% overspeed limit. Facilities may therefore be provided to enable the modem to accept data from a DTE having an intracharacter signalling rate of 2400 or 1200 bit/s +2.3%, −2.5%, with 8, 9, 10 or 11 bits per character by deletion of up to one stop bit in any four consecutive characters. A modem transmitter set to work with 2.3% maximum overspeed can handle data received from a DTE in accordance with § 4.1.1.

4.1.3 *Break signal*

If the converter detects $M$ to $2M+3$ bits all of "start" polarity, where $M$ is the number of bits per character in the selected format, the converter shall transmit $2M+3$ bits all of "start" polarity. If the converter detects more than $2M+3$ bits all of "start" polarity, the converter shall transmit all these bits as "start" polarity.

*Note* – The DTE must transmit on circuit 103 at least $2M$ bits of "stop" polarity after the "start" polarity break signal before sending further data characters. This ensures that the receiving modem can regain character synchronism.

4.2 *Receiver*

In the synchronous modes of operation, the modem shall give synchronous data to the DTE on circuit 104 under control of circuit 115.

In the start-stop modes, the intracharacter signalling rate provided to the DTE over circuit 104 shall be in the range 2400 to 2455 bit/s for Mode ii), in the range 1200 to 1227 bit/s for Mode iv). The nominal length of the start and data elements for all characters shall be the same. The length of the stop element shall not be reduced by more than 12% for the basic signalling rate range (or 25% for the optional extended signalling rate range) to allow for overspeed in the transmitting terminal.

The use of the basic signalling rate range is preferred since it results in lower distortion. The choice of range shall be made at time of installation, and shall be the same for both transmitter and receiver. It is not intended to be under customer control.

4.2.1 *Break signal*

The $2M+3$ or more bits of "start" polarity received from the transmitting modem shall be output on circuit 104. The modem shall then regain character synchronism from the following "stop" to "start" transition.

## 5 Scrambler and descrambler

Each transmission direction uses a different scrambler. The way to allocate the scramblers/descramblers is described in § 6.1.1.

A self-synchronizing scrambler/descrambler shall be included in the modem. According to the direction of transmission (see § 6.1) the generating polynominal is: GPC $= 1 + x^{-18} + x^{-23}$ or GPA $= 1 + x^{-5} + x^{-23}$.

At the transmitter the scrambler shall effectively divide the message polynomial (of which the input data sequence represents the coefficients in descending order) by the scrambler generating polynomial to generate the transmitted sequence; at the receiver the received polynomial (of which the received data sequence represents the coefficient in descending order) shall be multiplied by the scrambler generating polynomial to recover the message sequence.

The detailed scrambling and descrambling processes are described in Appendix I.

## 6 Operating sequence

6.1 *Scrambler/descrambler allocation and signalling rate selection*

6.1.1 *General switched telephone network (GSTN)*

On the general switched telephone network the modem at the calling data station shall use the scrambler with the GPC generating polynomial and the descrambler with the GPA generating polynomial (call mode). The modem at the answering data station shall use the scrambler with the GPA generating polynomial and the descrambler with the GPC generating polynomial (answer mode).

In some situations, however, for example, when calls are established on the GSTN by operators, bilateral agreement on call mode/answer mode allocation will be necessary.

The calling and answering modems automatically condition themselves to operate at the correct data signalling rate by exchanging rate patterns at the bit rate of 1200 bit/s during the operating sequences, as defined in § 6.3.1.



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6.1.2 *Point-to-point leased circuits*

Scrambler/descrambler allocation, data signalling rate selection and call mode and answer mode designation on point-to-point leased circuits will be by bilateral agreement between Administrations or users.

6.1.3 *Rate patterns*

The rate pattern is a scrambled sequence of a particular repeated octet transmitted 32 times.

Out of the possible 256 binary numbers, the 34 following hexadecimal numbers are selected:

01 – 03 – 05 – 07 – 09 – 0B – 0D – 0F – 11 – 13 – 15 – 17 – 19 – 1B – 1D – 1F – 25 – 27 – 2B – 2D – 2F – 33 – 35 – 37 – 3B – 3D – 3F – 55 – 57 – 5B – 5F – 6F – 77 – 7F

Each of the binary octets (numbers listed above) may be replaced by one of its rotations.

The transmission of an octet begins by the least significant bit.

Table 6/V.26 *ter* shows the relationship between an octet value and one or two bit rates (see Note 2 of the table) enabled in a modem.

TABLE 6/V.26 *ter*

**Rate pattern octet coding**

| Octet (see Note 1) | | Bit rate (bit/s) | | |
|---|---|---|---|---|
| Hexadecimal | Binary | 1200 | 2400 | 4800 (see Note 2) |
| | LSB | | | |
| 01 | 0 0 0 0 0 0 0 1 | X | | |
| 03 | 0 0 0 0 0 0 1 1 | | X | |
| 05 | 0 0 0 0 0 1 0 1 | | | X |
| 07 | 0 0 0 0 0 1 1 1 | X | X | |
| 09 | 0 0 0 0 1 0 0 1 | | X | X |

*Note 1* – In the case of an interface according to Recommendation V.24, only two rates can be selected by circuits 111 and 112. A new kind of interface under study may enlarge the possibilities.

*Note 2* – These octets assignments are provisional.

6.2 *V.25 automatic answering sequence*

The V.25 automatic answering sequence shall be transmitted from the answer mode modem on international GSTN connections. The transmission of the sequence may be omitted on point-to-point leased circuits or on national connections on the GSTN, where permitted by the Administration.

6.3 *Operating protocol*

The means of achieving automatic bit rate selection, initial echo cancellation and synchronism between the call mode and the answer mode modems on international GSTN connections and leased lines are shown in Figure 1/V.26 *ter*.

The automatic bit rate selection, initial echo cancellation and synchronizing signals are based on a half-duplex procedure. After this procedure, both modems shall continue to operate adaptive echo cancellation during duplex data transmission.

The operating sequence is divided into three sub-sequences: A, B and C (see Note).

Sequence A is the answering sequence according to Recommendation V.25.

Sequence B is the data bit rate selection sequence operated at 1200 bit/s.

Sequence C is the echo cancelling sequence operated at the selected bit rate.

At the end of these three sequences, the modem is conditioned to transmit and receive data.

*Note* – Manufacturers should note that the impedance of the modems as seen by the telephone line should not be varied throughout the duration of the connection.

6.3.1 *Description*

6.3.1.1 *Sequence A (answering sequence)*

6.3.1.1.1 *Call mode modem*

a) On connection to line it shall condition the scrambler and the descrambler in accordance with § 6.1.1.

b) In accordance with Recommendation V.25, after the detection of the 2100 Hz tone and a silent period of 75 ± 20 ms, the modem shall apply an ON condition to circuit 107.

6.3.1.1.2 *Answer mode modem*

a) On connection to line it shall condition the scrambler and the descrambler in accordance with § 6.1.1.

b) In accordance with Recommendation V.25, the modem is silent during 2.15 ± 0.35 seconds, sends a 2100 ± 15 Hz tone for 3.3 ± 0.7 seconds, and then remains silent for 75 ± 20 ms.

c) In accordance with Recommendation V.25, after the silent period, it shall apply an ON condition to circuit 107.

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6.3.1.2 *Sequence B (data bit rate selection sequence)*

The call and the answer mode modems are conditioned to transmit and receive at 1200 bit/s in a half-duplex mode.

6.3.1.2.1 *Call mode modem*

a) The modem waits until it detects at least 4 consecutive error free octets of the rate pattern (see Note 1).

The calling modem selects the maximum rate compatible with the answering modem or the maximum rate it can transmit.

b) Then, it remains silent during 250 ± 5 ms.

c) After that it transmits the synchronization sequence followed by 256 bits of a rate pattern corresponding to the selected bit rate in accordance with § 6.1.3.

d) Then, it applies the appropriate condition to circuit 112 (if used).

6.3.1.2.2 *Answer mode modem*

a) The modem transmits the receiver synchronization signals defined in § 2.7 followed by 256 bits of the rate pattern which indicates the set of rates available for the answering modem in accordance with § 6.2.

b) The modem remains silent until it detects at least 4 consecutive error-free octets of a rate pattern.

If a rate pattern is not detected within 2 seconds following the end of the rate pattern transmitted by the answering modem, it shall resume the operating sequence at the beginning of sequence B.

If the rate pattern indicates a rate not available, the modem shall disconnect from the line.

If the rate pattern indicates a rate available, the modem applies the appropriate condition to circuit 112 (if used).

c) Then, it remains silent again during 250 ± 5 ms.

d) In accordance with Recommendation G.164, the modem transmits a 2100 ± 15 Hz tone for 500 ± 50 ms to disable echo suppressors, then remains silent for 75 ± 20 ms.

6.3.1.3 *Sequence C (echo cancelling procedure)*

The call and the answer mode modems are conditioned to transmit, to receive and to cancel the echo at the selected data bit rate.

6.3.1.3.1 *Call mode modem*

a) The modem remains silent until 64 consecutive received scrambled binary 0s are detected. The modem shall then transmit the echo cancellation sequence (see Notes 2 and 3) until a sufficient degree of echo cancellation is available locally.

b) At the end of this sequence the modem shall be silent during 25 ± 3 ms and then transmit the receiver synchronization signals followed by scrambled binary 0s.

c) After detection of scrambled binary 0s, refinement of echo cancellation and detection of consecutive received scrambled binary 0s (Note 4) during a period of 64 bits, the calling modem shall apply the ON condition to circuit 109 and transmit scrambled binary 1s during a fixed period of 128 bits.

d) Then, the circuit 106 is enabled to respond to the condition of circuit 105 (see Notes 5 and 6).

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6.3.1.3.2 *Answer mode modem*

a) The modem transmits the echo cancellation sequence (see Note 2) until a sufficient degree of echo cancellation is available locally (see Note 3).

b) After this sequence, the modem is silent during 25 ± 3 ms and then transmits the receiver synchronization signals followed by scrambled binary 0s.

c) After detection of a signal transmitted by the calling modem during a period of 50 ± 5 ms, the answering modem remains silent.

d) After detection of 64 consecutive received scrambled binary 0s, the modem transmits the receiver synchronization signals followed by scrambled binary 0s.

e) After refinement of echo cancellation and the detection of a further 64 consecutive scrambled binary 0s whilst operating in duplex mode, the modem transmits scrambled binary 1s.

f) After detection of 64 consecutive received scrambled binary 1s the modem applies an ON condition on circuit 109 and enables circui 106 to respond to the condition of circuit 105 (see Notes 5 and 6).

*Note 1* – If 4 consecutive error-free octets of the rate pattern are not detected the modem remains silent.

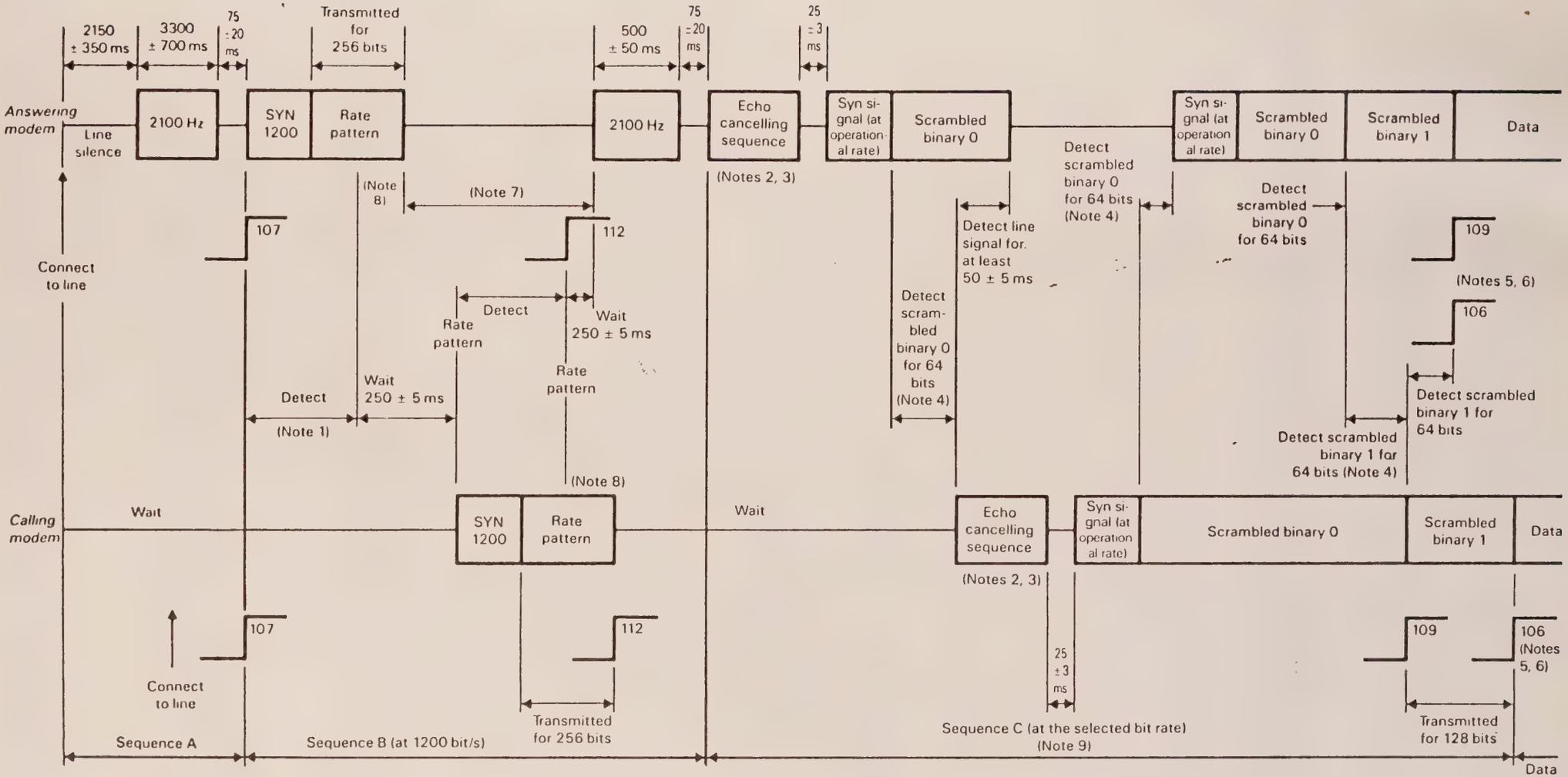
*Note 2* – The echo cancellation sequence must not contain more than 32 consecutive unscrambled or scrambled binary 0s.

*Note 3* – Manufacturers are cautioned that the time duration of the echo cancellation sequence has to be at least 650 ms when operating with network echo cancellers in accordance with Recommendation G.165.

*Note 4* – The detection of scrambled binary 1s or 0s should start only after the receiver synchronization signals are completed.

*Note 5* – When circuit 106 is in the OFF condition, circuit 103 shall be changed to the binary 1 condition.

*Note 6* – Users may wish to note that if in the DTE a time-out exists between the ON conditions of circuit 107 and circuit 106, this time-out shall be greater than 15 seconds.




*Notes 1 to 6* - See Notes 1 to 6 of § 6.3.

*Note 7* - If 4 consecutive octets of rate pattern are not detected within 2 seconds, the modem resumes sequence B.

*Note 8* - Rate pattern is defined in § 6.1.3.

*Note 9* - Sequence C is defined for operation at 2400 bit/s and 1200 bit/s and is under study for the higher bit rate of 4800 bit/s.

FIGURE 1/V.26 *ter*

**Operating sequences**

## 7 Half-duplex mode of operation

This mode of operation is optional.

### 7.1 *Synchronizing signals*

The synchronizing signals for both data signalling rates are divided into segments.

#### 7.1.1 *Segment 1*

The composition of segment 1 is continuous 180° phase reversals for 32 symbol intervals without protection against talker echo or for 256 symbol intervals with protection against talker echo.

#### 7.1.2 *Segment 2*

As defined in § 2.7.2.

### 7.2 *Response times of circuits 106 and 109*

See Table 7/V.26 *ter*.

TABLE 7/V.26 *ter*

| Response times | | | | |
|---|---|---|---|---|
| *Circuit 106* | With protection against talker echo | | Without protection against talker echo | |
| | 2400 bit/s | 1200 bit/s | 2400 bit/s | 1200 bit/s |
| OFF to ON | 240 ± 10 ms | 267 ± 10 ms | 55 ± 2 ms | 82 ± 2 ms |
| ON to OFF | ⩽ 2 ms | | | |
| *Circuit 109* OFF to ON | See § 7.2.1 | | | |
| ON to OFF | 5 to 15 ms | | | |

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#### 7.2.1 *Circuit 109*

Circuit 109 must turn ON after synchronizing is completed and prior to user data appearing on circuit 104. Circuit 109 is prevented from turning ON during reception of unmodulated carrier when the optional protection against talker echo is used.

#### 7.2.2 *Circuit 106*

Circuit 106 response times are from the connection of an ON or OFF condition on:

- circuit 105 to the appearance of the corresponding ON or OFF condition on circuit 106; or
- circuit 107 (where circuit 105 is already ON) to the appearance of the corresponding ON or OFF condition on circuit 106 as defined in the operating sequence in § 7.4.

### 7.3 *Clamping of circuits 104 and 109*

The DCE, when operating in half-duplex mode on a 2-wire line, shall hold circuit 104 in the binary 1 condition and circuit 109 in the OFF condition when circuit 105 is in the ON condition and, where required to protect circuit 104 from false signals, for a period of 150 ± 25 ms following the ON to OFF transition on circuit 105; the use of this additional delay is optional, based on system considerations.

7.4 *Operating sequence*

The means of achieving automatic bit rate selection, and synchronism between the call mode and the answer mode modems on international GSTN connections and leased lines are shown in Figure 2/V.26 *ter*.

The operating sequence is divided in two sequences, A and $B_1$.

The sequence A is the answering sequence according to Recommendation V.25 defined in § 6.3.1.1 above.

The sequence $B_1$ is the data bit rate selection sequence operated at 1200 bit/s.

At the end of these two sequences, the modem may now transmit or receive data.

7.4.1 *Description of sequence $B_1$*

During the sequence $B_1$ circuits 106 and 109 are clamped to the OFF condition.

The call and the answer mode modems are conditioned to transmit and receive at 1200 bit/s in a half-duplex mode.

7.4.1.1 *Call mode modems*

a) The modem waits until it detects at least 4 consecutive error-free octets of the rate pattern (see Note 1, Figure 2/V.26 *ter*). The calling modem selects the maximum rate compatible with the answering modem or the maximum rate it can transmit.

b) Then, it remains silent during 250 ± 5 ms.

c) After that it transmits the synchronization sequence defined in § 7.1 followed by 256 bits of a rate pattern corresponding to the selected bit rate in accordance with § 6.1.3 (see Note 1, Figure 2/V.26 *ter*).

d) Then, it applies the appropriate condition to circuit 112 (if used).

e) The modem remains silent during 250 ± 5 ms, and then it enables circuit 106 to respond to circuit 105 and circuit 109 to operate as defined in § 7.2.1.

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7.4.1.2 *Answer mode modem*

a) The modem transmits the receiver synchronization signals defined in § 7.1 followed by 256 bit of the rate pattern which indicates the set of rates available for the answering modem in accordance with § 6.1.3.

b) The modem remains silent until it detects at least 4 consecutive error-free octets of a rate pattern.

If a rate pattern is not detected within 2 seconds following the end of the rate pattern transmitted by the answering modem, it shall resume the operating sequence at the beginning of sequence $B_1$.

If the rate pattern indicates a rate not available, the modem shall disconnect from the line.

if the rate pattern indicates a rate available, the modem applies the appropriate condition to circuit 112 (if used).

c) Then, it remains silent again during 250 ± 5 ms.

d) After the silent period the modem enables circuit 109 to operate as defined in § 7.2.1.

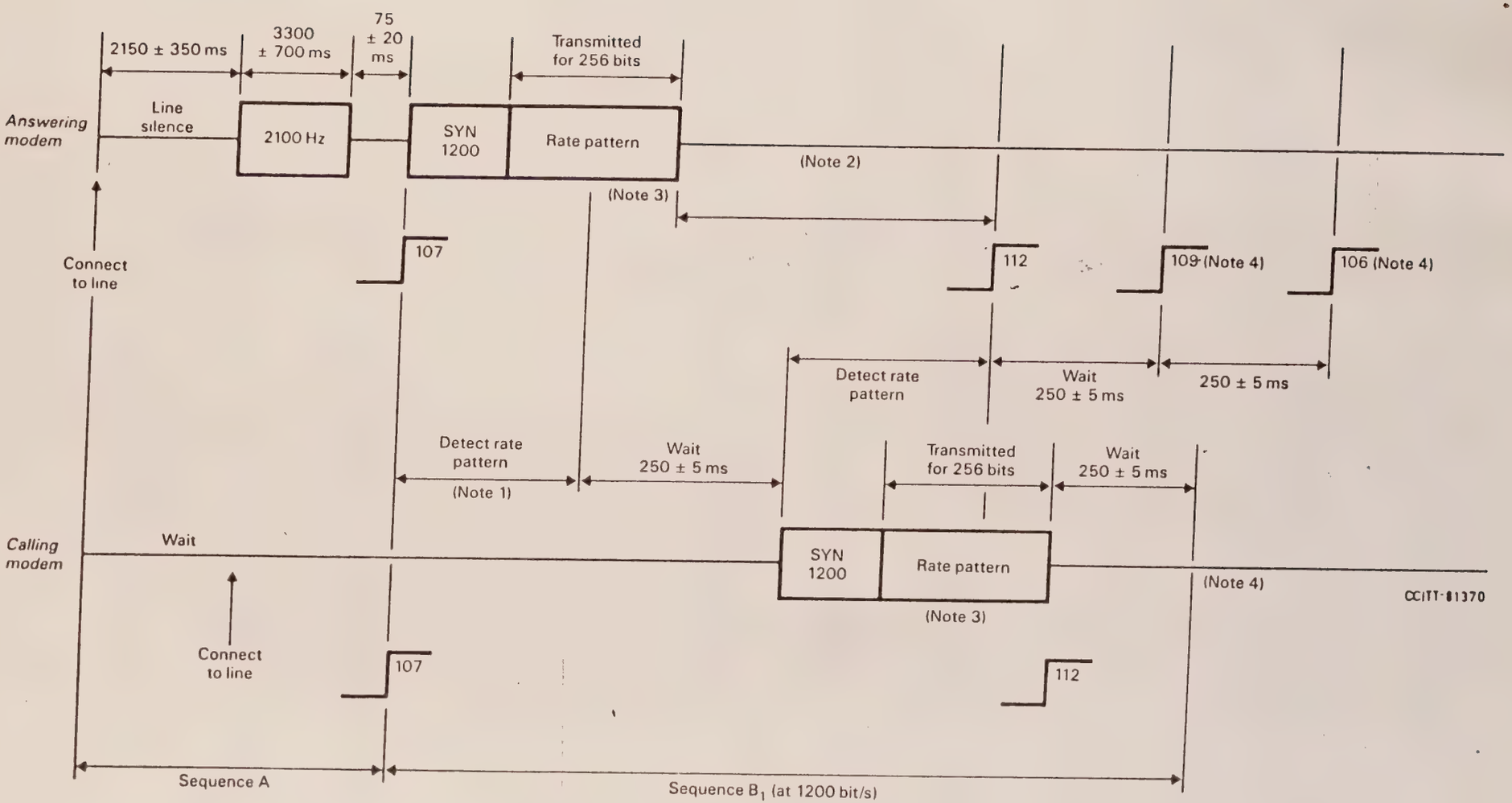
e) The modem waits 250 ± 5 ms prior to enabling circuit 106 to respond to circuit 105.

## 8 Testing facilities

Test loops 2 and 3 as defined in Recommendation V.54 shall be provided. Interface operation shall be as defined in Recommendation V.54.

8.1 *Remote loop 2*

Instigation and termination of remote loop 2 shall be in accordance with Recommendation V.54.




*Note 1* - If 4 consecutive error free octets of the rate pattern are not detected the modem remains silent.
*Note 2* - If 4 consecutive error free octets of the rate pattern are not detected within 2 seconds the modem resumes sequence $B_1$.
*Note 3* - Rate pattern is defined in § 6.1.2.
*Note 4* - The condition of circuit 106 shall respond to circuit 105, and the circuit 109 shall operate as defined in § 7.2.1.

FIGURE 2/V.26 *ter*

**Operating sequences in half-duplex mode**

APPENDIX I

(to Recommendation V.26 *ter*)

**Detailed scrambling and descrambling process**

I.1 *Scrambling*

The message polynomial is divided by the generating polynomial GPC = $1 + x^{-18} + x^{-23}$ or GPA = $1 + x^{-5} + x^{-23}$ (see Figure I-1/V.26 *ter* and I-2/V.26 *ter* respectively), according to the transmission direction. The coefficients of the quotient of this division taken in descending order from the data sequence $D_s$ to be transmitted. The expression of this sequence is:

$D_s = D_i \oplus D_s\, x^{-18} \oplus D_s\, x^{-23}$, when the generating polynomial GPC is used;

$D_s = D_i \oplus D_s\, x^{-5} \oplus D_s\, x^{-23}$, when GPA is used.

$D_i$ is the data sequence applied to the scrambler.

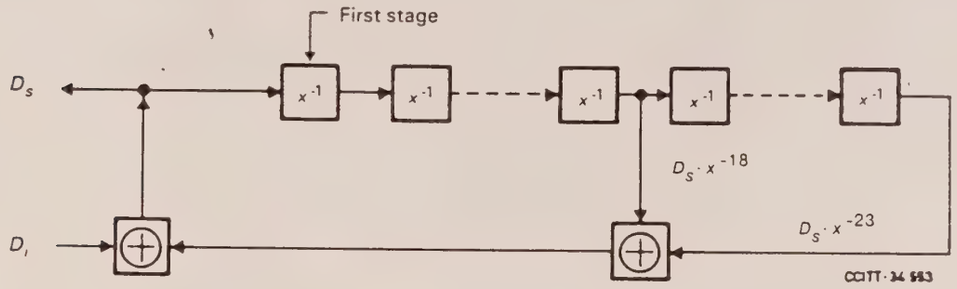



FIGURE I-1/V.26 *ter*

**Scrambler with GPC generating polynomial**

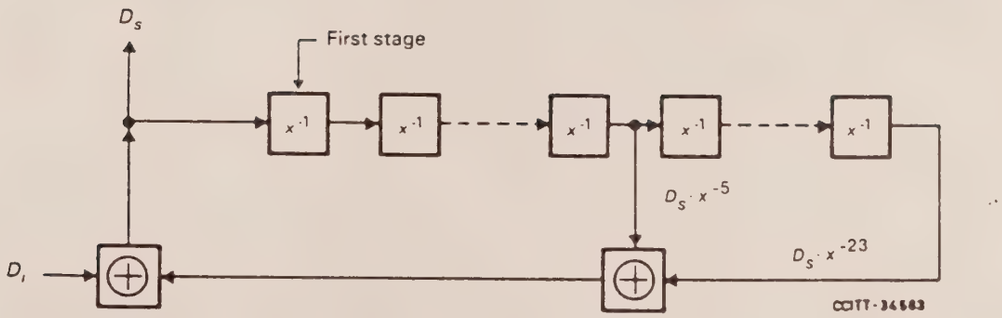



FIGURE I-2/V.26 *ter*

**Scrambler with GPA generating polynomial**

The polynomial represented by the received sequence is multiplied by the generating polynomial GPC or GPA (see Figures I-3/V.26 *ter* and I-4/V.26 *ter* respectively) to form the recovered message polynomial. The coefficients of the recovered polynomial taken in descending order form the output data sequence $D_o$ with the expression:

$$D_o = D_s (1 \oplus x^{-8} \oplus x^{-23})$$ for the GPC polynomial

or

$$D_o = D_s (1 \oplus x^{-5} \oplus x^{-23})$$ for the GPA polynomial.

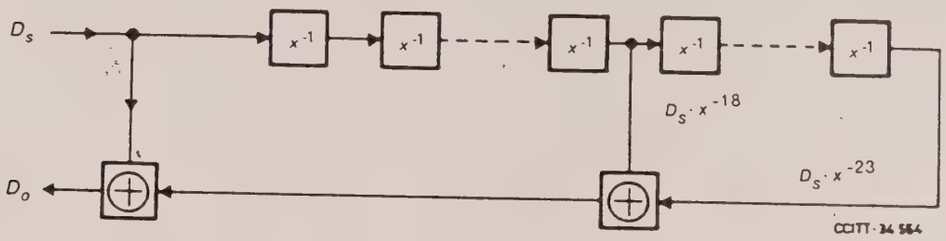



FIGURE I-3/V.26 *ter*

**Descrambler with GPC polynomial**

1402

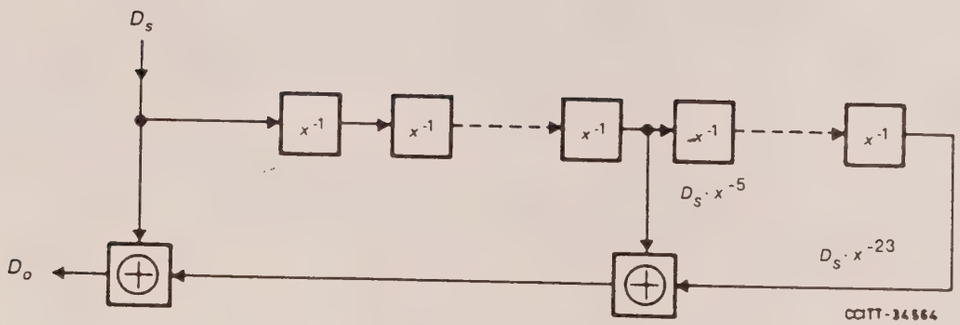



FIGURE I-4/V.26 *ter*

**Descrambler with GPA polynomial**

*Note* – The scrambler output patterns required to produce the synchronizing signal segment are as follows for both data rates:

GPC: 00 11 11 11 11 00 00 00 00 11 11 10 01 11 00 00 01 11 00
↑First bit

GPA: 00 11 11 11 11 00 00 00 00 11 11 10 01 11 00 11 11 10 00
↑First bit

Scrambler contents immediately preceding the output pattern above are as follows:

GPC: 10 01 11 11 11 11 11 11 00 00 01 1
↑

GPA: 01 10 00 00 11 10 00 00 11 10 00 0
First stage of scrambler ——————↑

THE AMERICAN RADIO RELAY LEAGUE, INC.
INTERNATIONAL SECRETARIAT OF THE INTERNATIONAL AMATEUR RADIO UNION
ADMINISTRATIVE HEADQUARTERS NEWINGTON, CONNECTICUT, U.S.A. 06111

July 16, 1986

HF GATEWAY STATIONS

This letter is being sent to all HF GateWay stations believed to be active now or within this past year and to others who have responded to Dave Sumner's "It Seems to Us ... Good News For Packeteers," in May, 1986 QST. The complete list of stations to which this is being mailed is included as Enclosure A. Thanks go to Hank Oredson, WØRLI, for furnishing much of this data.

I had the pleasure of meeting a number of you at the Dayton HamVention and was quite impressed with your dedication to HF packet radio, as well as your eagerness to be part of the League Special Temporary Authority request announced in Dave's May editorial. Some have written or telephoned to urge that the STA request move ahead as soon as possible.

There are some misconceptions floating around about some League actions since March of this year concerning packet-radio rules. So, I'll try to reconstruct the steps that led to where we are now, then talk about what's ahead.

You will recall that the FCC's Report and Order on PR Docket 85-105 was scheduled to become effective on March 14 and that it permitted automatic operation above 50 MHz but would have required a control operator to be present whenever relaying third-party traffic. This was clearly unacceptable to amateurs, and there were 19 petitions for reconsideration filed with the FCC, the League's included. On February 27, President Price, Washington Area Coordinator Williams and Executive Vice President Sumner met with the FCC staff. They left with the definite impression that a Petition for Extraordinary Relief would be accepted by the FCC, and the League filed one the next day. A waiver was granted to permit packeteers to retransmit third-party traffic under automatic control on frequencies above 50 MHz. Some of the Petitions for Reconsideration also asked for automatic control below 50 MHz, and this aspect of those petitions was dismissed by the FCC as not germane to PR Docket 85-105. The FCC staff indicated a willingness to entertain automatic control below 50 MHz as a separate issue. However, they were mindful that automatic operation at HF is a more complex issue and international because of ionospheric propagation. Because in the past there has been a need to demonstrate that new types of operation (such as SSTV) could be low risk, i.e., that they could coexist with other users of the HF bands, STAs have been used as a nonthreatening introduction to the ham bands. While some individuals were already convinced of the outcome and wanted a rules change, the more-certain route was to obtain the STA first, then with a good a track record to petition for a rules change.

At its March 22 meeting, the ARRL Executive Committee authorized approximately 15 stations for the STA request. This number was not merely picked out of the air but was felt to represent a reasonable quantity that would: (a) cover the US populated areas, (b) be large enough to demonstrate that amateur stations can be operated reliably on HF with this method of control, (c) show that undue interference would not be caused to other users, and, very importantly, (d) not be considered "excessive" by the FCC people who grant STAs.

Expressions of interest in being part of the STA trickled into ARRL HQ during May, and it was apparent that not all (that should have) had responded. We were also uncertain of the status of some of the stations listed as active on Hank Oredson's list. Timing was such that the prudent thing to do was to ask the ARRL Ad Hoc Committee on Digital Communication, which would be meeting in Newington on June 14-15, to prepare a recommended list of stations. The Digital Committee felt that if they picked the list, those stations omitted would resent being disinvited. The Committee asked the Chairman to contact Hank Oredson and at least several other key HF GateWay operators to find a way to firm up a list of stations needed for the STA. I have been in touch with Hank, and this letter is my vehicle for sounding you out on several things: (a) the list of stations, (b) frequency recommendations, and (c) concepts for improving HF packet relay.

In tackling these complex and interrelated subjects, let's first take a look at the accomplishments on HF packet relay thus far and assess some of the problems. (See Enclosure B.)

Next, let's review the Digital Committee's frequency recommendations. (See Enclosure F.)

Then, I offer a first-cut model on how we could work together to organize an improved concept of operation. (See Enclosure G.)

Finally, I would appreciate your completing the questionnaire (Enclosure J) and returning it to me in the business-reply envelope provided.

73,

Paul L. Rinaldo, W4RI
Chairman, ARRL Ad Hoc Committee on
Amateur Radio Digital Communication

cc: Digital Committee Members
Director Carey, Chairman, Membership Services Committee
Vice Director Comstock, Chairman, Blue Ribbon on Emergency Message Traffic

HF GATEWAY STATIONS

Enclosure A

*indicates response received  Please advise any corrections

| | |
|---|---|
| Karl Geng N1DL<br>45 Whispering Pine<br>Sudbury MA 01776 | 42.23N 71.25W FN42<br>145.09/14105 gateway<br>(H) 617-229-2762<br>(W) 617-276-1228 |
| Herbert H Salls WB1DSW<br>122 Giles Rd RFD #1<br>East Kingston NH | 42.99N 71.01 FN42<br>145.01/14103 gateway<br>(H)<br>(W) |
| Joseph E Galipeau Jr WA1LRL<br>11200 Young Dr<br>Brighton MI 48116 | 42.31N 83.46W EN82<br>VHF/14107 gateway<br>(H)<br>(W) |
| Ed Raso WA2FTC<br>946 Willard Rd<br>Newington CT 06111 | 41.42N 72.43W FN31<br>145.01/14107 gateway<br>(H)<br>(W) |
| Joseph A Fisher KC2TN*<br>33 Oakwood La<br>Atco NJ 08004 | 39.46N 74.53W FM29<br>HF/VHF gateway<br>(H)<br>(W) |
| Jack Colson W3TMZ<br>5609 Old Oak Dr<br>Mount Airy MD 21771 | 39.22N 77.09W FM19<br>HF/VHF gateway<br>(H)<br>(W) |
| Chuck C Nemec K3VPZ<br>9309 Old Court Rd<br>Baltimore MD 21207 | 39.21N 76.51W FM19<br>HF/VHF gateway<br>(H)<br>(W) |
| James W Diggs Jr K4AHO<br>7900 Plunkett Ave<br>Orlando FL 32810 | 28.32N 81.22W EL98<br>HF/VHF gateway<br>(H)<br>(W) |
| Fred Scalf Jr K4EID<br>4813 Palmstone<br>Knoxville TN 37918 | 35.57N 83.55W EM85<br>HF/VHF gateway<br>(H)<br>(W) |
| Charles A Lee Jr WA4EWV<br>6515 Glenhill Dr<br>Spring TX 77389 | 29.45N 95.21W EL29<br>VHF/14107 gateway<br>(H)<br>(W) |

| | |
|---|---|
| Larry J Wood KF4JF<br>Rt 1 Box 262<br>Hahira GA 31632 | 30.59N 83.22W EM80<br>VHF/14107 gateway<br>(H)<br>(W) |
| Theodore A Huff K4NTA<br>1829 NW Pine Tree Way<br>Stuart FL 33494 | 27.11N 80.15W EL97<br>VHF/14107 gateway<br>(H)<br>(W) |
| Don O'Neil WA4SZK<br>900 Beverly<br>Florence SC | 34.11N 79.45W FM04<br>HF/VHF gateway<br>(H) 803-662-1842<br>(W) 803-669-7753 |
| James E Scalf K4TKU<br>10045 SW 70th Ave<br>Miami FL 33156 | 25.46N 80.11W EL95<br>HF/VHF gateway<br>(H)<br>(W) |
| John Thomas Smith KI4XO*<br>2449 Old Forge Ct<br>Marietta GA 30062 | 33.57N 84.33W EM73<br>VHF/14107 gateway<br>(H)<br>(W) |
| P J Fagan WA5DVV<br>2412 E Birch Dr<br>Gulfport MS 39503 | 30.22N 89.05W EM50<br>145.01/14107 gateway<br>(H)<br>(W) |
| George Spurgeon N5EDH<br>1826 East LaDonna<br>Temple AZ 85283 | 34.33N 111.51W DM44<br>VHF/14107 gateway<br>(H)<br>(W) |
| James W Brooks W5ERO<br>13018 Independence Ave<br>San Antonio TX 78233 | 29.25N 98.29W EL09<br>VHF/14107 gateway<br>(H)<br>(W) |
| Walter Holmes Jr WD5GAZ<br>11726 Henley Dr<br>Houston TX 77064 | 29.45N 95.21W EL29<br>HF/VHF gateway<br>(H)<br>(W) |
| Dennis N Ely W5XO<br>Box 418<br>Gause TX 77857 | 30.47N 96.43W EM10<br>VHF/14107 gateway<br>(H)<br>(W) |
| Donald Simon NI6A*<br>2327 Alva Ave<br>El Cerrito CA 94530 | 37.54N 122.18W CM87<br>HF/VHF gateway<br>(H) 415-237-1381<br>(W) |

| | |
|---|---|
| Lee Dusabek WB6KAJ<br>1823 Lotus Pl<br>Brea CA 92621 | 33.55N 117.53W DM13<br>VHF/14103 gateway<br>(H)<br>(W) |
| John J. Eisenbrode KD6SQ*<br>7871 Montara Ave<br>Rancho Cucamonga CA 91730 | 34.06N 117.35W DM14<br>HF/VHF gateway<br>(H)<br>(W) |
| Del Winiecki K7BUC<br>2514 E Roma<br>Phoenix AZ 85016 | 33.26N 112.04W DM33<br>145.110/14103 gateway<br>(H)<br>(W) |
| John Vester KE7CZ<br>HC61 Box 1764<br>Dewey AZ 86327 | 34.50N 112.27W DM34<br>HF/VHF gateway<br>(H)<br>(W) |
| Tom Hogan WB7DCH*<br>26911 SE 456th St<br>Enumclaw WA 98022 | 47.12N 121.59W CN97<br>HF/VHF gateway<br>(H)<br>(W) |
| Wesley F Morris K7PYK<br>7422 E McKinley St<br>Scottsdale AZ 85257 | 33.30N 111.53W DM43<br>VHF/14107 gateway<br>(H)<br>(W) |
| Michael R Lamb WA7REL*<br>930 12th SE 105<br>Auburn WA 98002 | 47.18N 122.13W CN87<br>HF/VHF gateway<br>(H)<br>(W) |
| Franklin W McPherson KB7TV<br>5220 Benjamin Ave<br>Boynton Beach FL 33437 | 26.31N 80.04W EL96<br>VHF/7093 gateway<br>(H)<br>(W) |
| Thomas J Kryza KB8CI<br>10620 Fidelity Ave<br>Cleveland OH 44111 | 41.29N 81.41W EN91<br>VHF/14107 gateway<br>(H)<br>(W) |
| Joseph T Subich AD8I<br>7825 State Rt 188<br>Circleville OH 43113 | 39.36N 82.56W EM89<br>HF/VHF gateway<br>(H)<br>(W) |
| Fred Sole WB8LVP<br>2150 Manor Ave<br>Poland OH 44514 | 41.01N 80.37W EN91<br>VHF/14103 gateway<br>(H)<br>(W) |

| | |
|---|---|
| Peter Franks NI9D<br>PO Box 431<br>Brookfield WI 53008 | 43.03N 88.06W EN53<br>VHF/14107 gateway<br>(H)<br>(W) |
| Gregg R Lengling WD9DHI<br>N60 W6667 Victoria Ct<br>Cedarburg WI 53012 | 43.17N 87.59W EN63<br>145.09/7093 gateway<br>(H) 414-375-1231<br>(W) 414-375-2988 |
| William A Schroeder W9ZBD<br>4147 Forest Point Dr<br>Rhinelander WI 54501 | 45.38N 89.24W EN55<br>145.09/7093 gateway<br>(H)<br>(W) |
| David L Zeph W9ZRX<br>16310 Springmill Rd<br>Westfield IN 46074 | 40.02N 86.07W EN60<br>HF/VHF gateway<br>(H)<br>(W) |
| Robert A Schiers Jr NØAN<br>PO Box 171<br>McCallsburg IA 50010 | 42.13N 93.31W EN32<br>HF/VHF gateway<br>(H)<br>(W) |
| Dave Shavey KØHOA*<br>4745 Nightingale Dr<br>Colorado Springs CO 80907 | 38.50N 104.49W DM78<br>VHF/14107 gateway<br>(H)<br>(W) |
| Thomas Alan Bejot WBØHRG<br>906 Brentwood<br>Hastings NE 68901 | 40.35N 98.23W EN00<br>VHF/14107 gateway<br>(H)<br>(W) |
| Neal S Wood Jr KØKBY<br>4775 Pine Dr<br>Miami FL 33143 | 25.46N 80.11W EL95<br>VHF/14103 gateway<br>(H)<br>(W) |
| David C Fitz KIØQ<br>1124 Roosevelt Ave<br>Ames IA 50010 | 42.02N 93.37W EN32<br>HF/VHF gateway<br>(H)<br>(W) |
| David Freeborn KCØQJ<br>297 Vega Rd<br>Walsenburg CO 81089 | 37.37N 104.46W DM77<br>VHF/14107 gateway<br>(H)<br>(W) |
| Hank Oredson WØRLI<br>19 North Hill Rd<br>Westford MA 01886 | 42.34N 71.26W FN42<br>145.07/14107 gateway<br>(H)<br>(W) |

Enclosure B

## Review of Present HF GateWay Operation

Bob Bruninga, WB4APR, was one of the first stations, if not the first, to use his station as a bridge between HF and VHF (2 meters). Others quickly joined in. Then Hank Oredson, WØRLI, did something that a few others were only talking about: He wrote working code that allowed bulletin boards to forward messages to others automatically on to the destination. This served as a catalyst to activate about 35 stations (at any one time) across the US and a few overseas serving as "GateWays" to allow their local-area VHF nets to talk to distant stations on HF.

Hank's software proved to be robust and smart enough to work in both VHF and HF environments so that messages originated would get to the intended destination; no small accomplishment. Second, the HF GateWay operators overcame problems such as finding frequencies, tuning, modems, etc, and demonstrated that HF packet can indeed be used to move traffic.

Still there are problems, and no one will pretend that the system now in operation is without flaws. The bottom line is that messages take too long to transit the system, hours to days. This is due in large part to most stations staying on a few 14-MHz frequencies around the clock despite propagation and operating only when a control operator is present. When 14 MHz is bad for a path, the effect is poor or no reception at the destination, QRM and excessive retries. The net would work better if frequencies changed according to propagational paths so that day and night routing would be approximately the same. Still, one frequency is not enough to provide simultaneous coverage of various distances. It does not seem necessary to design an HF packet net for distances less than 300 miles as they can be covered by VHF/UHF relay. Covering distances from 300 to (say) 2500 miles generally requires three frequencies.

HF GateWay stations presently serve only 50% of the metropolitan areas of the country. Enclosure C is a list of Consolidated Metropolitan Statistical Areas (CMSAs) and Metropolitan Statistical Areas (MSAs) with notations of coverage by GateWay stations listed in Enclosure A. Enclosure D is a base map--a reduced version of the ARRL Grid Locator map of the Continental US with an insert for Hawaii--with solid black areas showing the CMSAs and MSAs. Enclosure E is an overlay showing the locations of the HF GateWay stations listed in Enclosure A. Actually 50% is not bad coverage for a spontaneous volunteer effort. Eventually, we need to serve all these areas as well as some of the less-populated areas of the country. However, to do so with the present method of (HF) frequency usage would not be feasible for reasons of propagation and congestion.

Clearly some better planning and coordination are needed to serve the required areas on something approaching a 24-hour-a-day basis.

Enclosure C

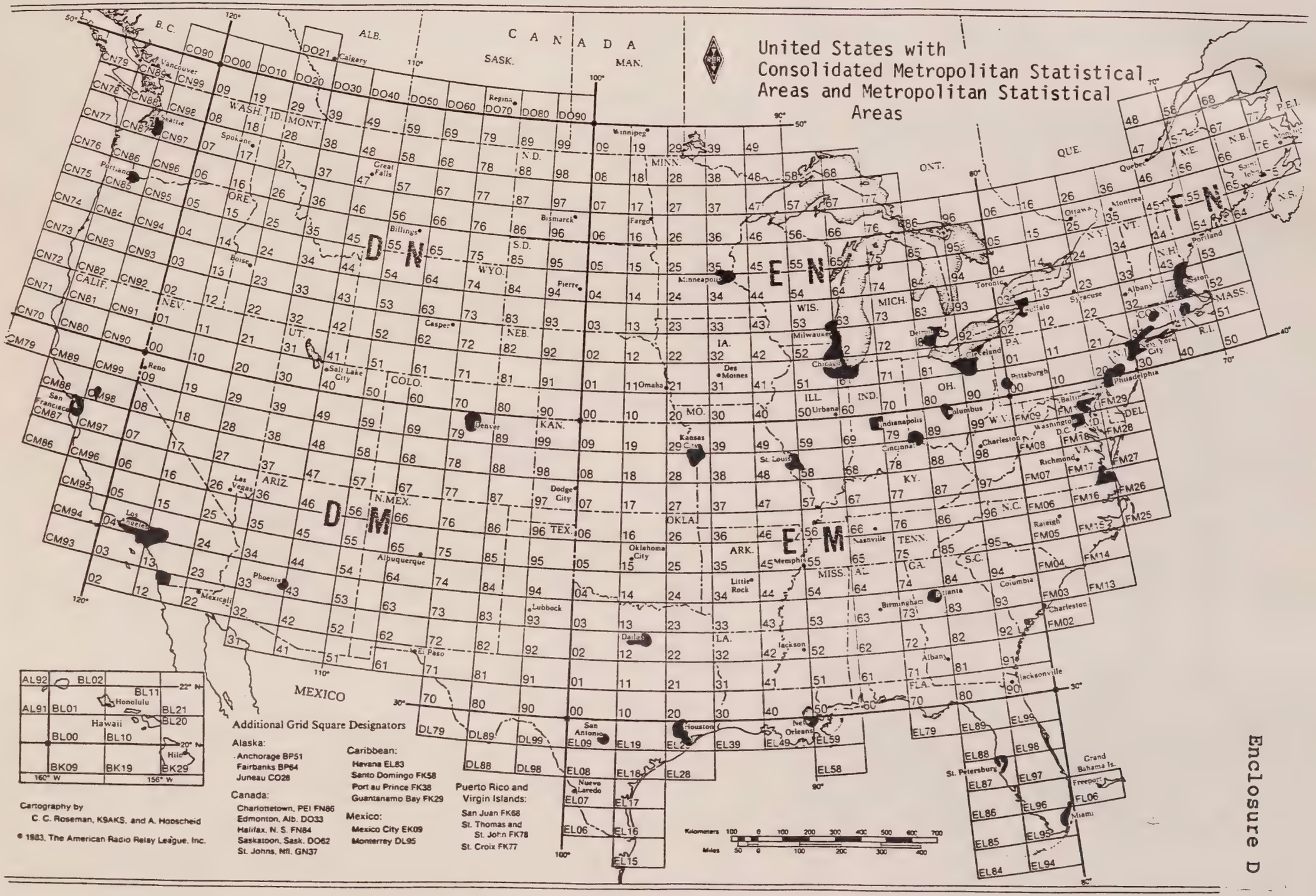
## Consolidated Metropolitan Statistical Areas and Metropolitan Statistical Areas

This is a list of CSMAs and MSAs identified in the FCC repeater-coordination docket (Jan, 1985). Asterisks show areas now served by one or more GateWay stations listed in Enclosure A. Ten of the 22 CMSAs are served (45%), and 8 of the 14 MSAs are served (57%), for a total of 36 areas, 18 of which are served (50%).

| CMSA | Pop (M) |
|---|---|
| *Boston-Lawrence-Salem, MA-NH | 3.7 |
| Buffalo-Niagara Falls, NY | 1.2 |
| Chicago-Gary-Lake Co, IL-IN-WI | 7.7 |
| Cincinnati-Hamilton, OH-KY-IN | 1.5 |
| Cleveland-Akron-Lorain, OH | 2.2 |
| Dallas-Ft Worth, TX | 2.8 |
| Denver-Boulder, CO | 1.5 |
| *Detroit-Ann Arbor, MI | 4.4 |
| *Hartford-New Britain-Middletown, CT | 1 |
| *Houston-Galveston-Brazoria, TX | 3 |
| Kansas City, MO-KS | 1.4 |
| *Los Angeles-Anaheim-Riverside, CA | 10 |
| *Miami-Ft Lauderdale, FL | 3 |
| *Milwaukee-Racine, WI | 1.5 |
| New York-Northern New Jersey-Long Island, NY-NJ-CT | 16.5 |
| *Philadelphia-Wilmington-Trenton, PA-NJ-DE-MD | 5.1 |
| Pittsburgh-Beaver Valley, PA | 2.2 |
| Providence-Pawtucket-Fall River, RI-MA | 1.1 |
| St Louis-East St Louis-Alton, MO-IL | 2.2 |
| *San Francisco-Oakland-San Jose, CA | 4.6 |
| San Juan-Caguas, PR | 0.6 |
| *Seattle-Tacoma, WA | 2.1 |
| | 79.3 |

| MSA | |
|---|---|
| *Atlanta, GA | 2 |
| *Baltimore, MD | 1.9 |
| *Columbus, OH | 0.9 |
| *Indianapolis, IN | 1.1 |
| Minneapolis-St Paul, MN-WI | 2 |
| *New Orleans, LA | 1.2 |
| Norfolk-VA Beach-Newport News, VA | 0.8 |
| *Phoenix, AZ | 1.5 |
| Portland, OR | 1 |
| *Sacramento, CA | 0.8 |
| *San Antonio, TX | 1 |
| San Diego, CA | 2 |
| Tampa-St Petersburg-Clearwater, FL | 0.6 |
| Washington, DC-MD-VA | 3.2 |
| | 20 |

Total: 99.3


United States with
Consolidated Metropolitan Statistical
Areas and Metropolitan Statistical
Areas
CANADA
B.C.
ALB.
SASK.
MAN.
ONT.
QUE.
N.B.
P.E.I.
N.S.
MEXICO
WASH.
ORE.
CALIF.
NEV.
ID.
MONT.
WYO.
UT.
ARIZ.
COLO.
N.MEX.
N.D.
S.D.
NEB.
KAN.
OKLA.
TEX.
MINN.
IA.
MO.
ARK.
LA.
WIS.
ILL.
MICH.
IND.
OH.
KY.
TENN.
MISS.
ALA.
GA.
FLA.
S.C.
N.C.
W.V.
PA.
N.Y.
VT.
N.H.
MASS.
R.I.
CONN.
DEL.
MD.
D.C.
N.J.
DMN
DMM
EMN
EMM
Vancouver
Seattle
Portland
Spokane
Great Falls
Billings
Bismarck
Fargo
Minneapolis
Winnipeg
Regina
Calgary
Boise
Pierre
Reno
Salt Lake City
Casper
Denver
Omaha
Des Moines
Chicago
Milwaukee
Detroit
Toronto
Buffalo
Syracuse
Albany
Montreal
Ottawa
Quebec
Portland
Boston
New York City
Philadelphia
Pittsburgh
Cleveland
Columbus
Indianapolis
Cincinnati
Charleston
Washington
Richmond
Baltimore
San Francisco
Los Angeles
Las Vegas
Phoenix
Albuquerque
El Paso
Mexicali
Dodge City
Kansas City
St. Louis
Urbana
Oklahoma City
Little Rock
Memphis
Nashville
Atlanta
Birmingham
Jackson
Dallas
Lubbock
Houston
San Antonio
New Orleans
Raleigh
Columbia
Charleston
Albany
Jacksonville
St. Petersburg
Miami
Grand Bahama Is.
Freeport
Nuevo Laredo
Honolulu
Hilo
Hawaii
Kilometers
Miles
Additional Grid Square Designators
Alaska:
Anchorage BP51
Fairbanks BP64
Juneau CO28
Canada:
Charlottetown, PEI FN86
Edmonton, Alb. DO33
Halifax, N. S. FN84
Saskatoon, Sask. DO62
St. Johns, Nfl. GN37
Caribbean:
Havana EL83
Santo Domingo FK58
Port au Prince FK38
Guantanamo Bay FK29
Mexico:
Mexico City EK09
Monterrey DL95
Puerto Rico and
Virgin Islands:
San Juan FK68
St. Thomas and
St. John FK78
St. Croix FK77
Cartography by
C. C. Roseman, K9AKS, and A. Hopscheid
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Enclosure D

## Digital Committee Frequency Recommendations

At its June 14-15, 1986 meeting, the ARRL Ad Hoc Committee on Amateur Radio Digital Communications discussed packet-radio frequencies in response to ARRL Board study motions and comments from packet users that packet frequencies are too congested. Below are excerpts of the meeting minutes that pertain to packet high frequencies:

**Study of Packet-Radio Frequencies:**

Board Minutes 45(a) (study designation of packet-radio traffic channels) and 45(h) (study recommended operating frequencies for VHF packet and HF packet radio) were discussed in great detail by the Committee. Because some of the frequencies were deterministically rather than experientially selected, the Committee requested the Chairman to contact Hank Oredsprn, WØRLI to vet the frequencies nominated by the Committee. This was done on June 20, and all HF channels shown below have run the gauntlet and are very close to reflecting actual on-the-air activity. Working recommendations of the Committee are as follows:

**General:**

Packet radio may be operated on any frequency where F1B emission is allowed in the FCC rules in accordance with good operating practice.

**20-meter Band:**

(a) Existing Frequencies: There are currently four packet-radio frequencies in regular use, as follows:

| Display (kHz) | Center (kHz) | |
|---|---|---|
| 14103 | 14101.3 | |
| 14105 | 14103.3 | |
| 14107 | 14105.3 | (Message forwarding) |
| 14109 | 14107.3 | |

Notes: The "Display" column refers to the frequency displayed on the transceiver display when the transceiver mode switch is set to lower sideband (LSB) and 1600- and 1800-Hz modem tones are used. The "Center" column indicates the actual center of the energy in the channel. Some interference to NCDXF-system beacons operating on 14100 from packet operations on 14103 has been reported. This interference appears to be from three causes: (1) excessive intermodulation products from some packet transmitters, (2) voice bandwidth receivers used by some listeners to receive the beacons, and (3) occasional off-frequency operation on the part of some packet stations using 14103.

(b) If voice-bandwidth receivers are to be protected from packet interference (a question on which the Committee takes no official position), the following frequencies are recommended:

| Display (kHz) | Center (kHz) | |
|---|---|---|
| 14105 | 14103.3 | (Message forwarding) |
| 14108 | 14106.3 | |
| 14111 | 14109.3 | |
| 14114 | 14112.3 | |

Notes: The lowest frequency has been moved upward to avoid interference to 14100-kHz beacons. The raster has been increased from 2 to 3 kHz in order to provide sufficient bandwidth and interchannel guard bands to permit 1200-baud operation (either under special temporary authority or an eventual rules change). (See channel diagram on page 4 of this Enclosure.) This would represent 12 kHz for packet operation on this band.

**40-meter Band:**

| Display (kHz) | Center (kHz) | |
|---|---|---|
| 7093 | 7091.3 | (Message forwarding) |
| 7096 | 7094.3 | |

Note: Nearest neighbors in the the Net Directory are: 7090 Mexican Emergency Net and 7105 Wyoming RACES Net

**30-meter Band:**

| Display (kHz) | Center (kHz) | |
|---|---|---|
| 10149 | 10147.3 | (Message forwarding) |
| 10146 | 10144.3 | |

Note: The only Net Directory entry for 30 meters is: 10105 Pacific CW Training Net

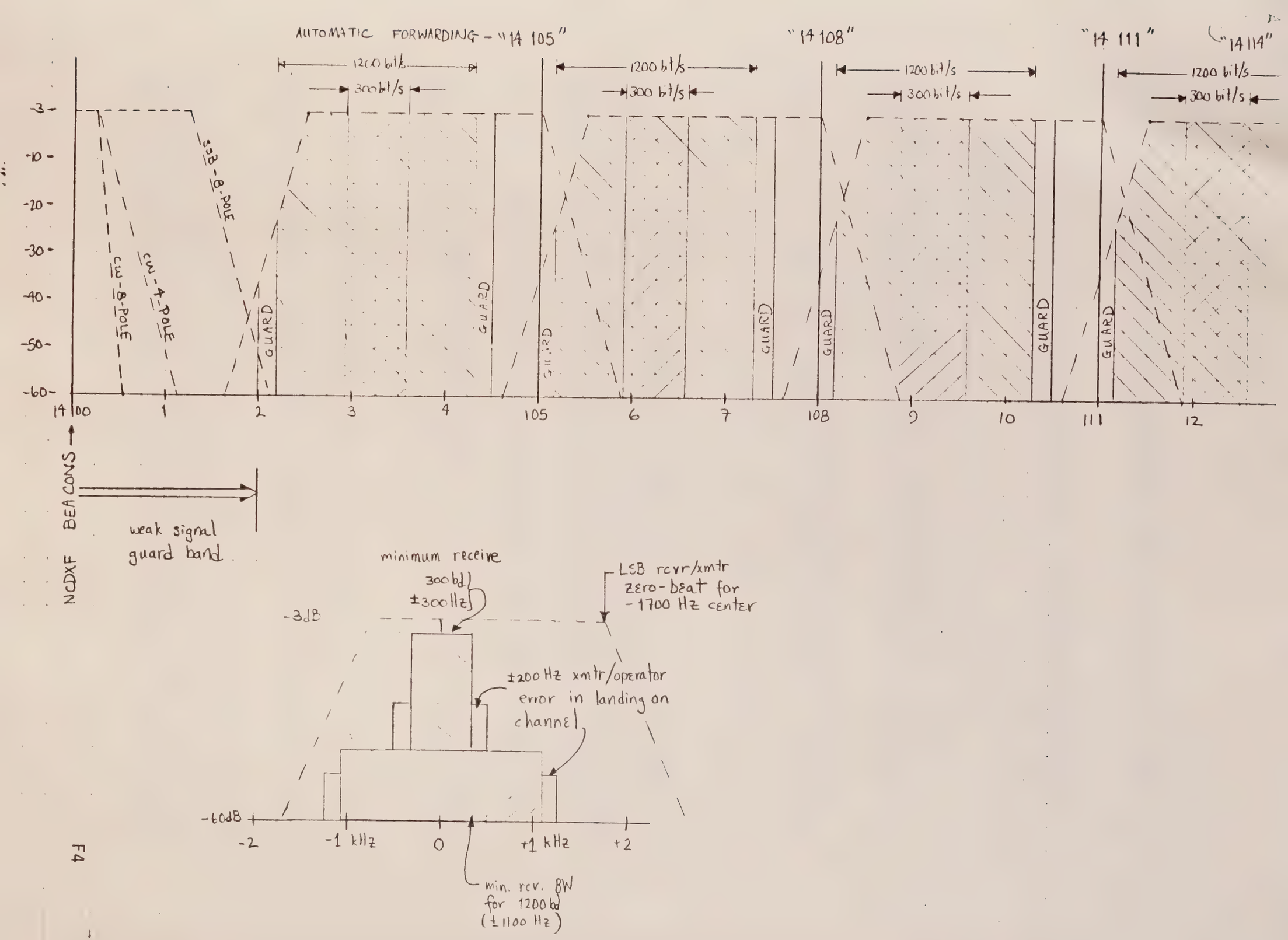
**80-meter Band:**

| Display (kHz) | Center (kHz) | |
|---|---|---|
| 3609 | 3607.3 | (Message forwarding) |
| 3614 | 3612.3 | |

Note: Nearest neighbors in the the Net Directory are: 3605 Buckeye Net RTTY (BRN), 3610 Eastern Pennsylvania CW Net (EPA), 3610 Kansas CW Net (QKS), and 3615 Louisiana Amateur Net (LAN).

**160, 15, 12 and 10-meter Bands:**

Further study is required. (There is some ongoing activity on 21105 and 21110 kHz, principally at 600 Bd, 1000-Hz shift in Region 1. It is desirable for the Committee to give some thought to 10-meter packet frequencies particularly in light of Novice Enhancement.)


AUTOMATIC FORWARDING – "14 105" "14 108" "14 111" "14 114"
1200 bit/s
300 bit/s
-3
-10
-20
-30
-40
-50
-60
SSB-8-POLE
CW-8-POLE
CW-4-POLE
GUARD
14 00
1
2
3
4
105
6
7
108
9
10
111
12
NCDXF BEACONS
weak signal guard band
minimum receive
300 bd
±300 Hz
-3dB
LSB rcvr/xmtr zero-beat for -1700 Hz center
±200 Hz xmtr/operator error in landing on channel
-60dB
-2
-1 kHz
0
+1 kHz
+2
min. rcv. BW for 1200 bd (±1100 Hz)

## Conceptual Model for an HF Packet Message-Forwarding Net

### 1. Introduction

Agreement on a model is needed for the orderly development of an HF net. The alternative is chaos and wasted resources.

### 2. Mission

The mission of the HF packet net is threefold:

a. to provide main-route relay of packets or packet messages between HF packet relay stations throughout the United States at distances greater than 300 miles (shorter distances being served by VHF/UHF);

b. to provide entry points for gateway stations serving the function of bridges between HF and VHF/UHF packet local-area networks wherever they are needed in the country;

c. to provide entry points for international packet traffic.

### 3. Terminology

a. HF relay -- a station responsible for moving packet traffic via HF between large areas generally in excess of 300 miles. (Distances of less than 300 miles normally can be handled by VHF/UHF.) While not part of the definition, HF relay stations usually will provide other services, such as acting as HF/VHF gateways and interfacing with stations using nonpacket modes.

b. HF/VHF gateway -- a station that acts as a bridge between HF packet stations and a VHF/UHF local-area network.

c. International HF gateway -- a station that functions as an interface between the domestic US packet network and HF packet stations located in other countries.

### 4. HF Relay Stations

a. Number of HF Relay Stations Needed

(1) For purposes of discussion, it is desirable to bound the quantity of stations needed to provide appropriate HF relay services.

(2) On the low side, it would be possible to cover the Continental United States with one central HF relay station fed by a large number of VHF/HF gateway stations. However, there would be times during the ionospheric propagation cycle when some paths are unreliable, particularly when Hawaii and Alaskan HF/VHF gateways come into the picture. At minimum, about three HF relay

stations are needed to cover the entire United States with adequate reliability. However, three appears to lack the redundancy needed for a robust network having alternate-routing opportunities. So a number somewhat higher than three is desirable, one large enough to provide alternate routes when needed.

(3) On the high side, since VHF/UHF can be used for paths up to 300 miles, HF relay sites are needed only 600 miles apart. That would translate to about 18 HF relay stations to cover the United States. But, 18 seems to be overkill, unjustified by HF propagational reliability, and probably contributing to congestion. Thus, a lower number should be chosen.

(4) If we multiply the lower bound (3) by 2 and divide the upper bound (18) by 2, we get a range of 6 to 9 HF relay stations as candidates for further investigation. Numbers in this range are sufficient to allow for reliable ionospheric coverage of the United States, alternate routing opportunities, and probably can be accommodated in the HF channels available without excessive loading.

(5) When the 6-9 range is applied to the map of the 48 contiguous states in such a way as to cover major population centers to the extent possible yet maintain roughly equal distances between stations, the number 7 appears to be a good candidate. This quantity would adequately provide for reliable ionospheric propagation between all HF relays and between HF relays and HF/VHF gateways serving all areas of the United States. The seven would be spread out throughout the 48 contiguous states about 1000 miles away from their neighboring stations. Such distances are ideal from a multipath standpoint and maximizes the range of usable frequencies below the MUF, according to Salaman.* It is also interesting to note that 1200 miles is the maximum range usually quoted for meteor-scatter (MS) communications, so these same 7 locations could be used for packet MS when that mode is developed.

b. Locations of HF Relay Stations

(1) Location Criteria

(a) about 1000 miles between neighboring HF relay stations;

(b) where each can tie into populated areas on VHF/UHF with (ideally) only one digipeat;

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Salaman, R K, "A New Ionospheric Multipath Reduction Factor (MRF)," IRE Transactions on Communications Systems, vol CS-10, Jun 1962, summarized in the ITT Reference Data for Radio Engineers, 6th ed, p 28-9.

(c) where noise levels are reasonable and suitable antennas are practical;

(d) where there is a support structure and continuity of the amateur(s) performing the HF relay function.

(2) Candidate Locations

Using the above criteria, analysis resulted in the candidate locations shown in Enclosure H. Note that some are circles, and some are different and larger shapes. Those in circles are suggested by one dominant population center, near which the HF relay station should be located in order to also serve as an HF/VHF gateway. The larger shapes indicate that the HF relay station could be located almost anywhere therein, preferably near the metropolitain area with the largest population or at very least good VHF/UHF service into that area.

(3) Discussion of Specific Candidate Locations

(a) NW (Northwest): Seattle-Tacoma, WA (a CMSA with a population of 2.1 M) with good VHF/UHF tie-in to Portland, OR (1 M) is a logical candidate location. Seattle is the natural VHF/UHF gateway to Vancouver, BC and for HF to Alaska. WB7DCH (Enumclaw, WA) is currently active as an HF/VHF gateway, and WB7REL (Auburn, WA) has indicated an interest in operating such a station.

(b) SW (Southwest): Los Angeles-Anaheim-Riverside (a CMSA with 10 M) appears to be the best location for an HF relay in California especially considering its VHF/UHF tie-in to San Diego (MSA with 2 M). KD6SQ (Rancho Cucamonga, CA) and WB6KAJ (Brea, CA) currently serve this area as HF/VHF gateways. If it weren't for the dominant population of the Los Angeles-San Diego corridor, San Francisco, CA (CMSA with 4.6 M) or Phoenix, AZ (MSA with 1.5 M) might qualify as candidates in that each has active HF/VHF gateways.

(c) RM (Rocky Mountains): This area is dominated by the Denver-Boulder, CO CMSA (1.5 M). Currently active HF/VHF gateway KØHOA (Colorado Springs, CO) is close enough to the Denver-Boulder area to give it good VHF/UHF service. KCØQJ (Walsenburg, CO), also presently active, may be able to serve the Denver-Boulder area with the VHF/UHF packet links in place.

(d) WG (West Gulf): The dominant population is the Dallas-Ft Worth, TX area (CMSA with 2.8 M). But it may be possible to serve a larger area including the Houston-Galveston-Brazoria, TX CMSA (3 M) and San Antonio, TX (MSA of 1 M) with good VHF/UHF intercommunication.

(e) CE (Central): The largest population center is the Chicago-Gary-Lake Co, IL-IN-WI CMSA (7.7 M) and the almost-contiguous Milwaukee-Racine, WI CMSA (1.5 M). So an HF relay would be best placed there. However, with reliable high-

speed VHF/UHF circuitry, an HF relay station located in the St Louis-E St Louis-Alton, MO-IL CMSA (2.2 M) or Indianapolis, IN MSA (1.1 M) could be alternatives. WD9DHI (currently active) and NI9D (status unknown) appear to be in locations to serve the greater Chicago-Milwaukee area.

(f) SE (Southeast): The Miami-Ft Lauderdale, FL CMSA has the greatest population (3 M) in this region. The Tampa-St Petersburg-Clearwater, FL MSA (0.6 M) is close enough to Miami to be considered an alternative with a good VHF/UHF pipeline into Miami-Ft Lauderdale. Atlanta, GA (2 M) appears to be a bit far from Miami to serve it well even with the best VHF/UHF links. Already active in the Miami-Ft Lauderdale area are K4TKU, KB7TV and K0KBY.

(g) NE (Northeast): The mid-Atlantic and northeast area from Virginia through New Hampshire is almost continuously populated and fair VHF/UHF linking with a good outlook for developing reliable, high-speed intercommunication. So, almost anywhere along this corridor would be acceptable for an HF relay except that New England would be about the best place along the east coast for a direct HF shot to Europe. WB1DSW and WØRLI (greater Boston area) have been serving this function cooperatively and are both active. However, WØRLI is planning to move to the west coast soon. N1DL, also in this same area, was active (status unknown). WA2FTC (Newington, CT and in the Hartford-New Britain-Middletown CMSA) is also active and has fair-to-good VHF digipeating into Boston. KC2TN (currently active) is in the Philadelphia-Wilmington-Trenton, PA-NJ-DE-MD CMSA (5.1 M). K3VPZ (currently active) and W3TMZ (status unknown) serve the Baltimore, MD MSA of 1.9 M.

c. HF Relay Station Frequency Coverage

(1) Path Requirements

(a) Short Distances: One requirement is that HF relay stations be able to communicate reliably with HF/VHF gateway stations roughly 300 to 600 miles away.

(b) Intermediate Distances: Another requirement (the one basic to HF relay) is that HF relay stations be able to work neighboring HF relay stations reliably, distances of 800 to 1200 miles.

(c) Long Distances: The third requirement is the ability to bypass the neighboring HF relay to the next, or distances of 1700 to 2100 miles. Such a capability would ensure a robust network, and eliminate unnecessary transit time and congestion by skipping intermediate HF relays whenever conditions permit.

(2) Frequency Requirements

(a) Number of Frequencies: Proper coverage of the short-, intermediate- and long-distance paths at each HF relay station requires simultaneous operation on three frequencies which change according to propagation. (How this can be done is described below.)

(b) Propagational Changes: ARRL HQ has access to the Institute for Telecommunication Sciences IONCAP computer at Boulder, CO and can publish frequency tables which change according to time of day, season and sunspot number for each HF relay station. Typically, during this phase of the sunspot cycle, the frequency tables for HF relay stations the continental United States would be elaborations on the following theme:

| Day | Night | Target Distances | Take-off Angle | Directionality |
|---|---|---|---|---|
| 7 | 3.5 | 300-600 mi | 60 degrees | Omnidirectional |
| 10 | 7 | 800-1200 mi | 30 degrees | Favor neighboring HF relay stations |
| 14 | 10 | 1700-2100 mi | 15 degrees | Favor HF relay stations beyond neighbors |

d. HF Relay Station Power Requirements: In order to permit maximum frequency reuse, it is desirable to run each transmitter at the 100-watt output-power level. The power would be adjusted upward or downward according to experience with retries and frequency reuse. In any event, operations on 10 MHz cannot exceed 200 watts output under present FCC rules.

e. HF Relay Station Organization

(1) Cositing Simultaneous Positions: It is obvious that the average Amateur Radio station is not equipped to run three HF packet-radio transceiving positions simultaneously because of cosite interference. Amateurs do not enjoy the luxury of separate receiving and transmitting sites so common in governmental and commercial HF stations of any size. Also, expecting an individual amateur to equip what is in effect three HF stations is unreasonable.

(2) Frequency Scanning: With computer control, it is possible to develop a scheme wherein a single transceiver would dwell on a channel in each band looking for callers, then move to the next band in a continuous sequence. (The Digital Committee recently heard a detailed briefing on such a system that is being proposed as a Federal Standard.) This technique is optimized for robustness and flexibility, not for the HF packet traffic-relay mode which needs the throughput of several concurrent channels.

(3) Clustering: This is a concept wherein the three positions are distributed to individual amateur packet-radio stations within a finite area to form a "cluster." Each position has the limited mission of covering only one HF channel, thus eliminating cosite interference and reducing economic impact on any one amateur. To reduce transit time, each station within the cluster would be required to have a dedicated VHF/UHF packet intercommunication channel. The intercom should be direct, through duplex repeater(s) that adds no transit time, or at very least no more than one digipeater. The general idea is that a packet or message coming in on one HF channel (say 14 MHz) and destined to be relayed to another HF relay on the same channel would stay within one station in the cluster. Alternatively if it came in on 14 MHz and was to be retransmitted on 7 MHz, the VHF/UHF intercom would shuttle it from the receiving station to the transmitting station in the cluster. This can be accomplished through the magic of two-port digipeater software.

(4) Forming the Clusters: A type of natural grouping seems to have taken place in some areas, except that the degree of cooperating or resource sharing is not fully known. Here are some examples of close by stations that could operate such clusters: WB1DSW, N1DL and WØRLI (until he moves); K4TKU, KB7TV and KØKBY; WB6KAJ and KD6SQ; WA7REL and WB7DCH; NI9D and WD9DHI; and possibly others with the help of VHF/UHF linking.

(5) Long-Term Support: It would be desirable to be able to count on a HF cluster station being there for the indefinite future. One bit of insurance would be for a club (either existing or start-up for this mission) to take on its formation and continuity.

## 5. HF/VHF Gateway Stations

a. Number of HF/VHF Gateway Stations Needed: Initially, HF/VHF gateway stations will be needed to join isolated VHF/UHF networks to the rest of the country via HF. Eventually, however, VHF/UHF linking should develop to the point where HF is needed only to leapfrog over stretches in excess of 300 miles whenever a saving in transit time would result. Probably the maximum number of HF/VHF gateway stations (in a cellular structure 300 miles apart on centers) counting those at cluster HF relay stations would be 50 to cover the 48 contiguous states.

b. Locations of HF/VHF Gateway Stations: It is likely that all stations listed in Enclosure A and not devoted to HF relay could continue to perform their HF/VHF gateway function. Additional HF/VHF gateway stations would be needed to serve areas not presently covered.

c. HF Gateway Station Frequency Coverage: In general, HF/VHF gateway stations would communicate with their neighboring HF/VHF gateway stations and HF relay station(s) on the lowest frequency guarded by the HF relay station. Except for alternate routing, this would be 7 MHz day and 3.5 MHz night. These

frequencies would be optimal because most paths to these neighboring HF packet stations would be on the order of 300 to 600 miles. Having HF/VHF gateway stations operate on the lowest frequency with minimum reliable power would ensure that the same frequencies can be reused elsewhere. (Initially, for the period of the STA, we propose only one frequency per band for automatic message forwarding. Later, it may become necessary to add more choices for the lowest frequencies to reduce QRM.)

d. HF/VHF Gateway Station Power Requirements: As in the case of HF relay stations, to permit maximum frequency reuse, it is desirable to run each transmitter at the 100-watt output-power level. The power would be adjusted upward or downward according to experience with retries and frequency reuse.

e. HF/VHF Gateway Station Configuration: HF/VHF gateway stations would be operated by individual amateurs, the only change being use of lower frequencies. They could continue to sprout spontaneously and would require little coordination except to let everyone know which HF relay station to route through for traffic addressed to that HF/VHF gateway or its VHF users.

**6. International HF Gateway Stations**

a. Need for International HF Gateway Stations: Operation of an international HF gateway station must be under operator control for the foreseeable future in order to ensure that third-party traffic is exchanged only with countries with which the United States has such arrangements. These countries are:

Antigua and Barbuda (VP2A), Argentina (LU), Australia (VK), Belize (V3), Bolivia (CP), Brazil (PY), Canada (VE), Chile (CE), Colombia (HK), Costa Rica (TI), Cuba (CM), Dominica (J7), Dominican Republic (HI), Guyana (8R), Haiti (HH), Honduras (HR), Israel (4X), Jamaica (6Y), Jordan (JY), Liberia (EL), Mexico (XE), Nicaragua (YN), Panama (HP), Paraguay (ZP), Peru (OA), St Christopher and Nevis (VP2K), St Lucia (J6), St Vincent and the Ggrenadines (VP2S), Swaziland (3D6), Trinidad and Tobago (9Y), United Kingdom (special-event stations with call sign prefix GB followed by a number other than 3), Uruguay (CX), and Venezuela (YV).

The United States also has an agreement with the United Nations permitting third-party traffic with amateur stations 4U1ITU in Geneva, Switzerland and 4U1VIC in Vienna, Austria.

(1) Map of Third-Party Countries: The above country list has been prepared in map form. (See Enclosure I.) These countries would appear to be local choices for locations of HF packet relay stations outside the United States and could be the basis of a worldwide HF relay network. The Commonwealth of Puerto Rico could be a good spot for a gateway to Europe and Africa. Hawaii and other Pacific islands under the United States flag could provide excellent coverage of the Pacific Ocean and East Asia.

(2) International Coordination: Development of a worldwide HF packet network will require coordination with the IARU regions and IARU member-societies. International Affairs Vice President Tod Olson, KØTO, also happens to be the Digital Committee Board Liaison and will be discussing packet issues at IARU regional conferences.

b. Locations of International HF Gateway Stations: Natural locations for international HF gateway stations within the 48 contiguous states would appear to be in the following areas, preferably integrated with domestic HF relay clusters:

(1) Europe: New England.

(2) Carribean and South America: Florida.

(3) Central America: Texas.

(4) Alaska: Seattle.

(5) Pacific, East Asia, and Australasia: California.

c. HF Gateway Station Frequency Coverage: Typically only one frequency would be required. Propagation predictions could be furnished for each path on a point-to-point basis, and frequencies could change from band to band accordingly. Specific channels different from those used for domestic HF relay would be selected. These paths will require the use of every band from 3.5 through 28 MHz over the sunspot cycle.

d. International HF Gateway Station Power Requirements: Because of the long paths involved, international HF gateway stations would run up to the legal limit, but restrict their power output to levels required for good throughput without excessive interference to others. For reliability, this is probably the territory of the "big guns."

e. International HF Gateway Station Configuration: This function would require a single amateur station preferably integrated into an HF relay cluster.

Enclosure H

Enclosure I

Enclosure J

## HF GATEWAY STATION QUESTIONNAIRE

| Licensee's Name, Call Sign & SSID, Mailing Address | Fixed Station Operation Location (per FCC License) |
|---|---|
| | |

| Home Telephone | OK to Release? (circle) YES NO | Work Telephone | OK to Release? (circle) YES NO |
|---|---|---|---|
| | | | |

DESCRIPTION OF EQUIPMENT USED FOR YOUR HF GATEWAY

| Transceiver Type and Power Output | Frequency Control:<br>__ Synthesized, digitally controllable<br>__ Synthesized, not digitally controllable<br>__ VFO controlled<br>__ Crystal controlled |
|---|---|
| RF Power Amplifier Type (if any) and Power Output | |
| Modem | Antenna(s) |
| TNC | Computer |
| What HF Channels Do You Guard and When | Call Signs of Other HF Gateways You Reliably Hear |

DIAGRAM OF FULL-TIME VHF/UHF DIGIPEATERS WITH WHICH YOU CAN CONNECT SHOWING FREQS AND CALL SIGNS

## HF GATEWAY STATION QUESTIONNAIRE (Page 2)

ENCLOSURE A – HF GATEWAY STATIONS (LIST)

Please list any corrections or additons

ENCLOSURE F – DIGITAL COMMITTEE FREQUENCY RECOMMENDATIONS

| Do you agree with the Committee's frequency recommendations? (Attach any explanation) | (circle) YES NO | Would you be willing to change to these frequencies on September 1, 1986? | (circle) YES NO |
|---|---|---|---|

What are your suggestions for specific packet frequencies in the 1.8–, 21–, 18–, and 24–MHz bands and why? (The League has recently petitioned the FCC for release of the 18–MHz band.)

What are your suggestions for specific packet frequencies in the 28.0–28.3 MHz band for use by stations holding General class licenses and higher? (It looks like what little RTTY is in the band operates in 28080–28095 kHz with W1AW RTTY bulletins on 28095. How about an initial packet freq of 28098, then work upward in a 3–kHz raster if/when Novice Enhancement takes effect?)

Assuming that Novice enhancement goes through, what are your suggestions for the specific packet frequencies for Novice and Technician class licensees to use in the 28.1–28.3 MHz segment where F1B is proposed in PR Docket No. 86–161. The following band plan reflects current IARU thinking: 28.0–28.05 CW only; 28.05–28.15 CW & digital; 28.15–28.19 CW only; 28.19–28.20 time–shared beacons; 28.201–28.225 continuous–duty beacons; and 28.225–28.3 digital (beacons in this segment are to be relocated by January 1, 1990.)

How do you think we should plan to handle integrating Novices and Technicians (after Novice enhancement is in force)? (For example, should a General or higher class licensee operate a 28–144 MHz gateway? Or should we be thinking in terms of petitioning the FCC to consider digipeater operation in the 28.0–28.3 MHz band?)

## HF GATEWAY STATION QUESTIONNAIRE (Page 3)

ENCLOSURE G - CONCEPTUAL MODEL FOR AN HF PACKET MESSAGE-FORWARDING NET

| Do you like the conceptual model in general? | (circle) YES NO | Would you be willing to work within a plan of this type if there is general agreement? | (circle) YES NO |
|---|---|---|---|

What are your ideas for improving the plan? (Attach additional explanation if needed.)

Under such a plan, what role would you envision for your own station? (Examples: continue as HF/VHF gateway; be (short-, intermediate-, long-distance) station within HF relay station cluster; act as HF international gateway.)

If an HF relay cluster station is to be in your area, what stations do you see possibly cooperating? Under a club (club call)? With what VHF/UHF intercommunication? How tied into the local VHF/UHF packet digipeaters and PBBSs?

QUESTIONS CONCERNING LEAGUE APPLICATION FOR SPECIAL TEMPORARY AUTHORITY FOR AUTOMATIC OPERATION

| Would you like to be one of the participating stations, capable of automatic control and willing to file report at end of STA period? | (circle) YES NO | Is your Amateur Radio license up-to-date with current mailing and transmitter address? (If not, be sure to file an amended 610 ASAP.) | (circle) YES NO |
|---|---|---|---|
| Is your station equipped for 1200-baud operation using CCITT V.23? (800-Hz shift)(Modems using Am7910 or Am7911 World Chips are.) | (circle) YES NO | Would you be willing to equip your station with a 600-Hz shift modem capable of operating at speeds up to 1200 bauds if part of the STA? | (circle) YES NO |

Remarks on STA

THE AMERICAN RADIO RELAY LEAGUE, INC.
INTERNATIONAL SECRETARIAT OF THE INTERNATIONAL AMATEUR RADIO UNION
ADMINISTRATIVE HEADQUARTERS NEWINGTON, CONNECTICUT, U.S.A. 06111

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JAY A. HOLLADAY
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QST
OFFICIAL JOURNAL

August 28, 1986

HF GATEWAY STATIONS

Gentlemen:

Please accept this as an interim reply to your completed questionnaires. So far, I have heard from the following 30 stations:

WB1DSW, N1DL, KC2TN, W3TMZ, K3VPO, K4EID, K4NTA, KI4XO, WA4SZK, K4TKU, KN5D, W5XO, WB6KAJ, KD6SQ, WB7DCH, K7PYK, KB7TV, AD8I, WB8LVP, K8MMO, WD9DHI, W9TD, W9ZBD, W9ZRX, NØAN, KØHOA, KIØQ, KCØQJ, KØKBY, and WØRLI.

Returned questionnaires have slowed down to a trickle, so analysis can begin. I appreciate your thoroughness; there is a wealth of useful data. It will take a few weeks to digest the data and complete the plan based on your inputs.

There were a few incidental requests (such as for Form 610s, QST address changes, etc) with the questionnaires. If you asked for anything like that, it's enclosed; I hope I didn't miss any.

Incidentally, the ARRL Blue Ribbon Committee, which is reviewing emergency communications and the National Traffic System, is keenly interested what we're working on. They see an effective HF packet network as an important resource for handling disaster traffic. Blue Ribbon Committee Chairman Tom Comstock, N5TC, has asked us to look for ways to work in some emergency-communications exercises to demonstrate the effectiveness of HF packet radio. The Simulated Emergency Test is coming up soon and provides an opportunity for at least some limited packet involvement.

73,

Paul L. Rinaldo, W4RI
Chairman, Ad Hoc Committee on
Amateur Radio Digital Communication

cc: Digital Committee
Chairman, Blue Ribbon Committee

August 11, 1986

AD HOC COMMITTEE ON AMATEUR RADIO DIGITAL COMMUNICATION

Gentlemen:

Let this be a newsletter unto you.

Board Meeting

On July 23, just before the Board Meeting, I had a chance to spend an hour or so with our Committee Board Liaison Tod Olson and Alternate Marshall Quiat. We went over events since the last Board Meeting to prepare Tod for his oral report to the Board. Before our get-together, Tod had the opportunity to read the packet I had mailed to 43 HF gateway operators on July 16. He decided to overlay Enclosures E (station locations) and H (proposed HF relay cluster locations) on an overhead transparency for his oral report. In presenting this domestic HF packet-relay model to the Board, Tod recommended that Blue Ribbon Committee members Joel Kandell, KI4T, and Rick Whiting, WØTN, work with the digital committee to ensure coordination with NTS. Tod also elected to use Enclosure I (world map showing countries which allow third-party traffic) for another transparency. He mentioned that the IARU Region 2 meeting in Buenos Aires October 20-25 and the IARU Administrative Council meeting immediately following will be opportunities to discuss worldwide packet networking with other member-societies. (Incidentally, I will be writing a paper for the Region 2 meeting as a follow-up to the one I wrote for the Region 3 Conference, which was published as Appendix 1 of ARRL Amateur Radio Computer Networking Conferences 1-4.) The IARU Administrative Council has already adopted Resolution 85-7 which charged the International Secretariat to: (a) review international regulations to identify modifications required to establish a worldwide packet network, (b) collect from member-societies information on how domestic regulations limit or help development of packet radio (and networking), and (c) develop recommendations for Administrative Council consideration on how problems should be addressed. So, packet radio seems to be beginning to get the kind of serious attention it needs in the international sphere. I'm sure that we'll have something to report after these IARU meetings.

The full minutes of the Board Meeting will appear in the September issue of QST. Quoted below is about the only minute that has direct interest to the Digital Committee:

> "33) Mr. Beebe, as Liaison, presented the report of the Emergency Communications Advisory Committee. The committee's work had centered on two maters: protocols of packet radio message handling and matters concerned with the support of the National Weather Service by amateur operators. On motion of M. Butler, seconded by Mr. Frenaye, it was unanimously VOTED that, in light of the ECAC report, the Board support in principle the direction of current Packet Bulletin Board Systems (PBBS) software development which is bringing it more in line with standard NTS format."

The underlying need, of which the Digital Committee is aware, is to have interoperability -- as far as the human operator is concerned -- when refiling from packet-radio PBBSs to NTS voice/CW/RTTY nets and vice versa. It is not necessary for the physical-level transmission formats to be identical for the application/presentation-level formats to be the same to the operator, if that's what the operator wants.

Wally: Have you any progress to report on your evaluation of Jack Sanders' radiogram software? Is this the right direction? Let's restart our dialog on this topic.

Encore to Digital Committee Meeting

On June 16, several Digital Committee members stayed on and took the opportunity to meet with Dave Sumner to talk about the STA to permit automatic operation in the HF bands. We briefed Dave on the Committee's discussion about splitting off the 1200-baud HF tests as a separate STA from that for automatic operation. He accepted the point that timing, suboptimal modems, etc would make it impossible to make this the definitive 1200-baud test, and recommended that we stipulate that in the STA request so that the FCC doesn't take it as such. It is possible to get some valuable 1200-baud operational experience using 800-Hz shift afforded by the V.23 mode in Am7911 modems. The Committee members also probed possible reconsideration of the Executive Committee's decision to limit the STA to "approximately 15 stations." It was pointed out that restricting the frequencies to one channel per HF band would automatically set a limitation on how many stations could effectively contend for a given channel, and thus keep the STA participants from unduly interfering with other users of these bands. The key question seems to be how many stations the FCC would be willing to authorize. At that meeting, it was agreed to poll the HF operators to see who and how many wanted to be included before facing the question of how to sort them.

Woodshedding the STA Problem

Recall that the Committee had asked me to poll WØRLI and other key HF gateway operators to share the problem with them (and hopefully give them some ownership of the eventual outcome). I used most of the June 28-29 weekend to brood over how to approach the HF/VHF gateway operators to make them part of the decision-making process. About all that was clear to me after that was it was unrealistic to expect replies from perhaps 35 individuals that would make any sense unless they were given a straw man.

The 3-day Independence Day weekend provided an opportunity for total immersion to build the straw man. Somehow, it came together. It took until July 16 to clean it up and get it in the mail to the 43 HF/VHF gateway stations listed in Enclosure A. Then, at the request of W9ZRX, I send additional packages to KN5D, KR5S, W6CUS and K8BI, also to WD4LYV, K8MMO and K9TD at their request. That makes 50 mailed to candidate stations.

Questionnaire Returns

As of last count, 22 questionnaires have been returned. I don't think that you want to see these replies piecemeal, so I'll accumulate them another week or so before either reproducing or summarizing them for you. In general, however, their support the straw man has been virtually unanimous.

STA Rumor Mill

Praise Allah that I don't hear all the rumors out there in Packetradioland. I have heard roundabout that it isn't worth responding to the questionnaire because "they" have already decided everything. Well, it appears that I'm at the vortex of this, and I have no idea what we've already decided. It would be cruel to deprive the mongers of their rumors so don't tell them that all options are still open at this point.

Sixth Computer Networking Conference

At our June meeting, we agreed on the southwest as the venue for the 6th packet conference in 1987. Harold Price and Wally Linstruth have been working on finding a site, and have been in touch with Southwestern Division Director Fried Heyn. Fried sounded out the convention organizers for Las Vegas and found an uncertain welcome.

Fried thinks that the Southwestern Division Convention in Scottsdale, AZ (Oct 9-11) would be a good host for the conference. He reported that the convention organizers, Lyle Johnson and the Flagstaff packeteers supported the idea of having the packet conference in Scottsdale. If we elect to avail ourselves of this opportunity, we would need to work with chairman Jim Cushing, KD7FW, 602-867-7002, and Charles Mulkin, W7KB, 602-947-0296.

Wally called me on August 8 to say that he and Harold feel that Southern Califoria is the best location because of the density of the packet population, which should virtually guarantee a good turnout. Harold is coordinating with Fried. Also they are in touch with John Browning on the chance that an AMSAT-cosponsored event might provide the best draw.

Spec-Comm Editorial on Kantronics

In his August issue, Mike Stone carried the enclosed one-page editorial on the Kantronics' KPC-2400. It would be easy to write a rebuttal mentioning innovation, free enterprise, that the market will decide, etc, but that might just dignify the editorial. On the phone, Phil Anderson said he's not planning any action. We're not going to mention this in Gateway, despite receiving a complimentary copy clearly for that purpose.

Gateway

We're doing a review of Gateway. We included a questionnaire in the July 11 issue to get some reader input. I would appreciate your thoughts on how we can improve its service to the packet community. Gateway Editor Ed Raso is set to move to Rhode Island in October, which is less convenient than his simply dropping by the ARRL HQ building by virtue of living in Newington. We'd like to examine all the alternatives (including multiple contributing editors), but a decision needs to be made within the next few weeks. Please let me know if you have specific suggestions.

73,

Paul L. Rinaldo, W4RI
Chairman

**DESIGN AUTOMATION LIMITED**
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Mr.Paul L.Rinaldo, W4RI,
American Radio Relay League,
Newington,
CT 06111,
U.S.A.

Our Ref.B32 7th August 1986.

Dear Paul,

I enjoyed reading an article "Packet Radio in Region 3" published in the BARTG magazine "Datacom", Summer 1986 issue. It answered many questions but glossed over a point of great interest to me, namely, how should we modulate the carrier with data.

I have had a lot to do with telephone type modems, particularly line powered ones, but having used these on radio it seems to me that it is a stupid thing to do and we should instead be shifting the carrier directly by the digits. Unfortunately many people say this is illegal or immoral or something, and so I am currently trying to show that there is nothing really unorthodox or different about it, and in fact I think it represents a way of getting very narrow band signals with faster data than we normally use.

To get this moving, I am writing a series of articles in a UK magazine and one of them, about side bands and modulation is enclosed herewith. Would you care to look through this and see whether it clashes in any way with your views, whether you can agree with the theme, and improve the way in which I display it.

I am of course hoping that the idea will spread far and wide and so I am looking for an American magazine who could take the same or similar article in order to promote fast data across the Atlantic. Feel free to pass these papers on to any editor who will correspond with me - so that we don't get at cross purposes. We are already working on 29 metre FM rigs with this idea in mind and I am glad to see from your notes that above 28 mHz it is acceptable to use 1200 baud!

I look forward to an early comment from you and please note that I do have various forms of electronic mail if you can use them but I don't think my antena system would get you on 20 metres just as the moment.

Every good wish.

Yours sincerely,

R.J.Redding.

July 5, 1986

TO: Ed Raso, WA2FTC
Editor, The ARRL Packet Radio Newsletter
225 Main Street
Newington, CT 06111

PACKET RADIO ARRIVES ON MONTSERRAT ISLAND, WEST INDIES

On Sunday, June 8, 1986, I arrived at the QTH of VP2MR on Montserrat Island, W.I. with my PK-64/HFM-64, its power supply and cabling. I also carried along my Commodore 64. I borrowed a Commodore 64 power supply and monitor from VP2MF, next door. Sunday afternoon, after hooking up to a TS-120 driving a TET, 3E beam 60 feet up, I made my first ever, Packet Radio connect with PJ2MI, Jose, at Curaco, Netherland Antilles!

Before I left Texas to go to Montserrat, two Packet "experts," KL7CB and KE5JU gave me a two hour cram session on the PK-64, for 20 meters. They operated on 14.103.5 Mc and gave their blessings to the hookup. After that I dismantled, packed and took off for the West Indies, a brand new Packet operator, with no contacts logged!

Operating Packet from Montserrat Island was an adventure! This was the fifth year I had operated as VP2MKS. It was some fun, reading the manual and punching up the wrong keys. After several days of operating where I found many Hams on Packet without much more experience than my own, I began to put it all together. I did not use a disk drive or a printer so I logged my contacts manually.

I found many USA connects available. After several days I started logging what I saw on the monitor screen, and was surprised at the Packet activity in Europe, and elsewhere.

The following is a list of connects I made, followed by calls I saw transmitting on the monitor: All were on 14.103.5 Mc.

G4VLS-Paul
G5DS-John
KG4TM-Tim
G3LDI-Roger
DL3AAP
LA60CA-KNUT
G3IFM
G4BIO-Andy
PA3EAE-Vera
IØWX-Pete
ON8HB-Alain
IØJX-Tony
HK5FIR-Diego
PJ2MI-Jose
IØCNR-Raffaele
JA1DST-Ninoru

The following I monitored and could tell they were transmitting by the PK-64/HFM-64 *system.

DJ6TZ
G3NRW
TI3DJI
ZF1GC
HK3FW
LU8DSS
TI8ALG
ZS2BK
I5UCH
9M2CR-1
TI3DJI
XE4EN
DJØSO
F5PX
HK4CCX
HK3CBA
HP1XJZ
I2JR
YB5QZ
GM3DUR
HK3AVA
SM5BKI
XE1OE
OH1VR
ON7LE
I5CW
DF2EG
JA3MQY
DL1AR
DL1MI

I had a "Connect Request" from 9H1E on Malta, but I was trying to handle Multiple Connects from Holland, Germany, England, Norway, and Wales. I did not have the experience to get back to him.

This report should show that 20 Meter Packet is taking off. What other type of communication allows one to communicate on the visual screen with IØCNR near "Roma," and listen to the World News from the BBC in London at the same time?

Ken Shaw

Ken Shaw, Life Member ARRL
K5VZN/VP2MKS
2014 Boston Dr.
Irving, Texas 75061

cc: Perry Brittain
W5STI/VP2MR

Konrad Hollatz
VP2MF

PR

April 4, 1986

Syd Horne, VE3ECO
531 Victoria Ave.
Belleville, Ontario K8N 2C6
CANADA

Dear Syd:

Thanks for your comments on the April editorial.

I'm going to share your letter with the ARRL Committee on Amateur Radio Digital Communication, which presently is grappling with several of the issues you raise.

Nice to hear from you -- I recall your early work on SSTV.

73,

Sincerely,

David Sumner, K1ZZ
Executive Vice President

DS:ja
cc: Paul Rinaldo

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F.C.C. #2
1986 APR -4 AM 9:31

531 Victoria Av
Belleville
Ontario K8N 2G6
Canada

26 March 1986

Mr David Sumner K1ZZ
Executive Vice President
American Radio Relay League
225 Main St
Newington
CT 06111
U.S.A.

Dear Mr Sumner,

This letter is with reference to your editorial in the April 1986 issue of QST entitled "Packet Fever" and the FCC Docket 85-105. I also believe that it is possible in a few years time for the Amateur Radio packet network to permit an amateur to send a message to any point on the subcontinent in a very short space of time and at no cost to the sender. Unfortunately it is also true that the FCC Docket 85-105 has the potential of crippling this worthwhile Amateur Radio development.

I would like to comment on some of the statements made in your editorial. While it is true as you state that any packet station can monitor what is happening on the channel it would be quite difficult and in many cases, impossible,for an amateur to determine what are "inappropriate" packets simply because it would not be possible for him to readily decipher certain types of packets.

While plain text would indeed present no problem, data which could be the object code from a compiled program, sometimes referred to as a binary image,would only be decipherable by the sender and the receipient. In fact the code referred to can be said to be encrypted.

Perhaps the FCC Commissioners wish to protect the Amateur Radio packet network from data which is coded in a manner that is undecipherable by anyone including knowledgable persons. Unfortunately the potential for such abuse exists if no action is taken to prevent such abuse. I might add that having a control operator at every repeater does not solve the problem.

Traditionally it has been considered that information transmitted by amateurs is nonsecret in nature and also that the information is in the public domain. I feel that this principle should also apply equally to the Amateur Radio packet network. If this premise is correct then an acceptable solution can be found to this problem.

Since the Amateur Radio packet network can be used to transmit text, pictures, graphics, computer programs etc and if these messages were transmitted encoded in a form for which a standard existed then the messages could be easily deciphered either on-line or at a later date. No encrypted messages should be allowed on the network. In this context an encrypted message is a message that can only be deciphered by the sender and the receipient.

A Standard could be an Amateur standard such as the AX.25 Amateur Packet-Radio Link-Layer Protocol, a north American standard such as Electronic Industries Association (EIA) standards or Canadian Standards Association Standards or International standards such as standards prepared by the International Standards Organisation (ISO). Indeed the AX.25 standard originated from an ISO standard.

If computer programs were transmitted then the source code must be transmitted. The source code could, of course be compiled and used by any person who received this data because the information was in the public domain.

It should also be possible for an amateur to obtain special permission for experimental purposes to transmit data which is specially encoded and for which no standard exists. This would permit experimentation in various coding techniques.

I do not believe that the above proposal will be difficult to follow in fact the mere fact that development in this field will be conducted in accordance with published standards could only assist development in this exciting field. The AX.25 Amateur Packet-Radio Link-Layer Protocol is an excellent example of standardisation which caused a surge of activity in this field.

Personally I am keenly interested in the development of amateur packet radio. Currently I am engaged in the development of a system for transmitting pictures by packet radio. The system follows international and north american standards.

I hope that the above comments will be of use to you and the League in reaching an acceptable amendment to FCC Docket 85-105.

Very truly yours,

Syd Horne VE3EGO
Technical Coordinator for Ontario (CRRL)

cc T.Atkins
VE3CDM

W4RI /9NG -- 21 LINES.
From: GARY W9TD 7/7/86 18:25
READY FOR MESSAGE? y
Subject: HF STA
To: Paul Rinaldo, W4RI
Paul,
I wonder if this HF STA for packet will only include active PBBS stations? I do not run a PBBS now, but desire to experiment with higher speed modems on HF. I have been on HF packet since the TAPR beta test and have much experience. I already have some ideas on a better 300 baud or faster modem for HF and have completed about half of a paper on optimizing HF digital communications for publication in the Ham press somewhere. As of yet I have not built any improved modem because I have too many projects in the fire such as the TAPR 9.6/56kbaud 220 radio, the CAPRA network controller hardware, the above paper, etc.
Gary Kaatz, W9TD
President, Chicago Area Packet Radio asociation

July 23, 1986

Gary Kaatz, W9TD
President,
Chicago Area Packet Radio Association
125 Forest Park Lane
Hoffman Estates, IL 60194

Dear Gary:

This is in response to your message of 7/7/86.

We are not necessarily limiting the STA only to active PBBS stations, although their activity can be taken as a sign of sustained interest. Unless I've slipped a mental cog, I recall that you were active with WA4APR in the earliest HF/VHF gateway tests.

So that you will be starting from about the same point as others, I am enclosing a package recently mailed to 43 HF/VHF gateway stations. I would appreciate your returning a completed questionnaire.

Your work on faster HF modems sounds interesting. I hope that you will send it to ARRL HQ for consideration for QEX or QST, depending on the thrust of the material.

73,

Paul L. Rinaldo, W4RI
Chairman, Ad Hoc Committe on
Amateur Radio Digital Communication